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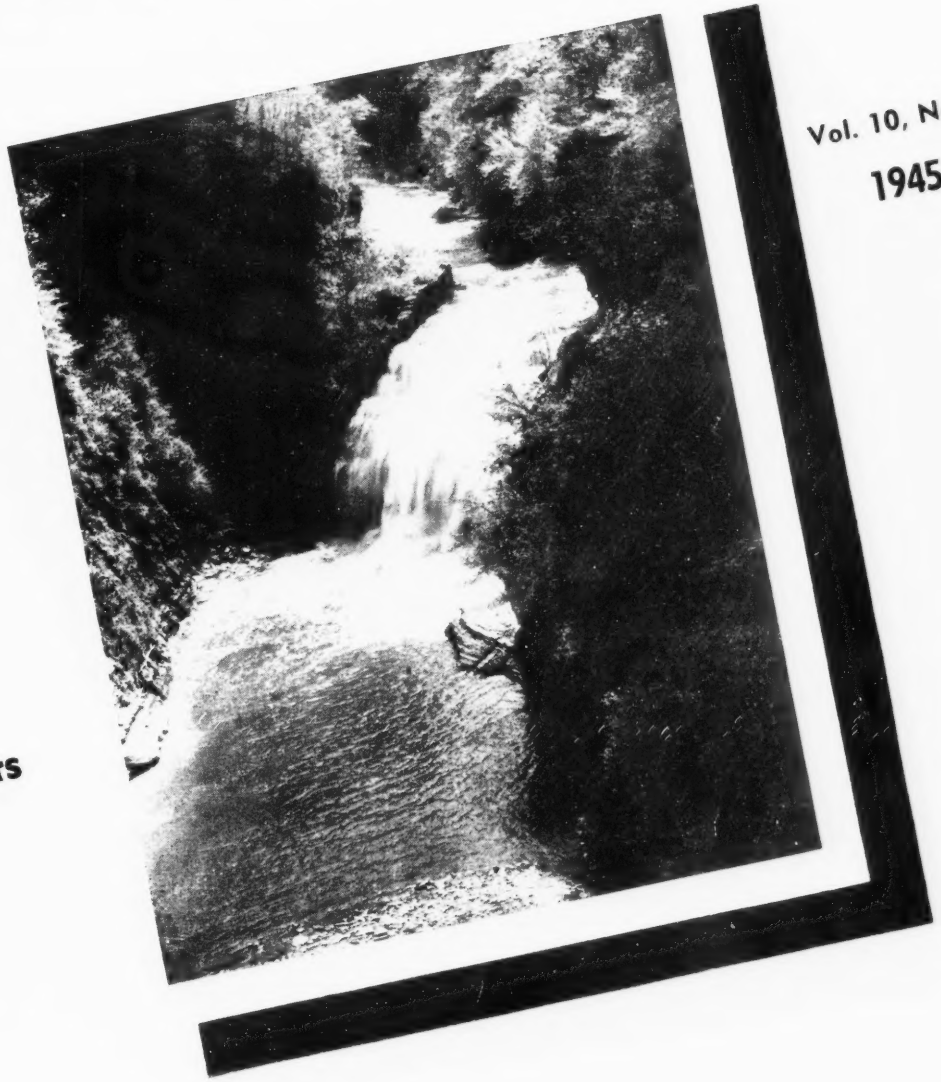

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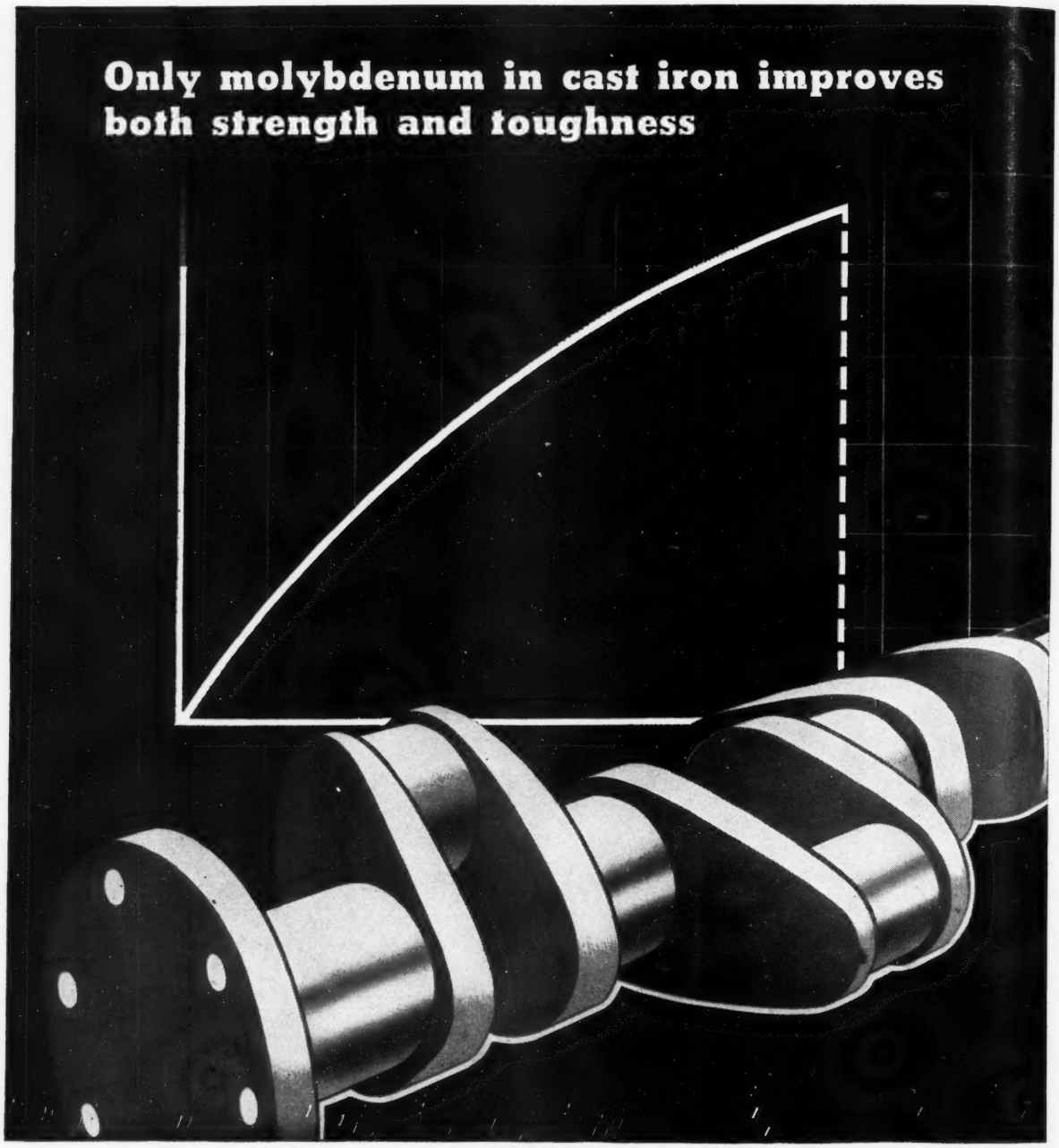

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The CORNELL ENGINEER

1945

Volume 10 Number 7

A 1921 view of Triphammer Falls with the old foot bridge.

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Spring-freshened falls in Fall Creek gorge viewed from the Stewart Avenue bridge.

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FRONTIS

Army Air Force mechanics servicing a Turbo Jet engine on a Bell P-59A Airacomet training plane.

—Courtesy General Electric

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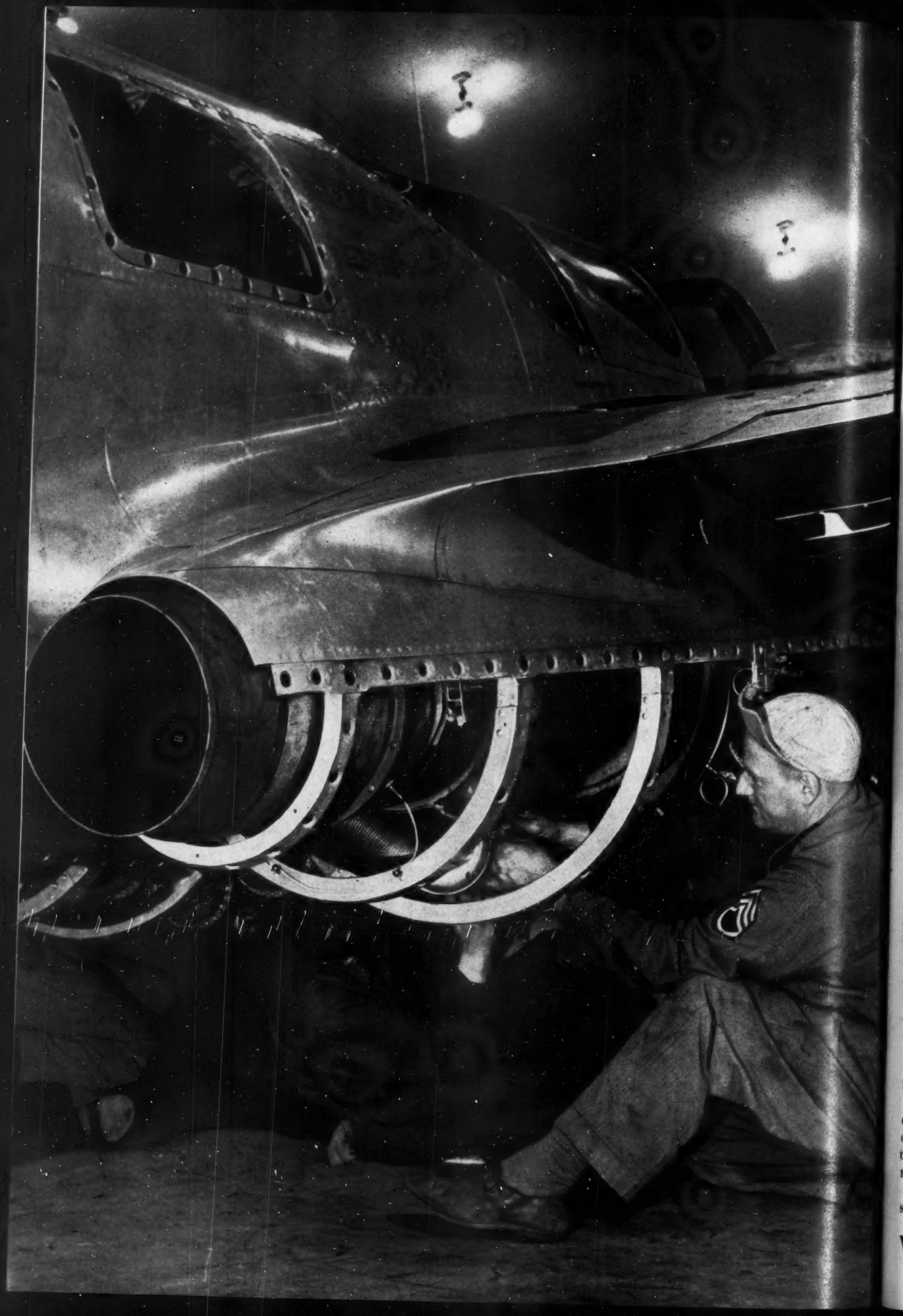

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POST-WAR WAGE TRENDS

By FRANK D. NEWBURY, M.E. '01

Vice President of the Westinghouse Electric & Mfg. Co.

I HAVE been asked to discuss the subject of post-war wages, and I interpret this: what should be done about wage rates during the transition from war production to the competitive conditions of peace for which we should prepare? Should wage scales be increased, decreased, or kept just where they now are?

I need not stress the difficulties that surround these questions and their emotional nature. These questions concern the incomes of millions of workers, and the relations among employers, employees, labor unions, and government. Nevertheless, I believe this question should be brought out into the open in spite of the heat it may generate, because it is going to have a very important bearing on post-war employment and prosperity.

The Approach

I wish to say, at the beginning, that I have no official responsibility for labor relations in my own work, and the opinions that I will present are merely my own. I present them as such and welcome your questions and even your disagreement, if that should prove to be the way I make you feel.

My approach to this subject is that all of us—employer, employee, labor union, and government—are aiming at the same target; we all wish to adopt policies that will result in the maximum possible employment, and the maximum possible national production and income. I would, therefore, relate this subject of wage scales to these primary aims in this way:

The best wage scales, and the ones we should try to reach, are the ones that will contribute most effectively to maximum employment and maximum production.

I propose to develop my subject starting from a few simple foundation principles that affect total employment and total national production. The first of these principles goes pretty far down to bed rock; it is the proposition that: We are paid out of what we produce, and if we expect more pay, that is, real pay in goods, we must produce more. Total wages and salaries paid out, over the long term, must, if industry is to remain self-supporting and solvent, come out of total national production.

Second Principle

It is rather startling to realize that financially the American people have not been on this self-supporting basis for the past 15 years. We have not lived within our current income since 1929.

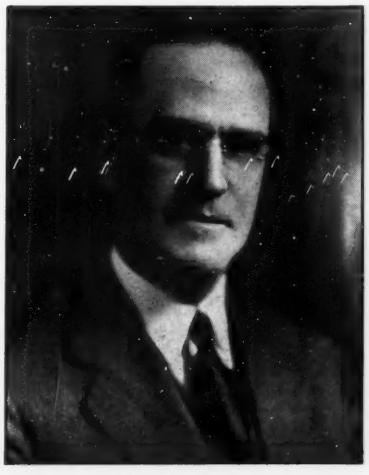
The second principle I wish to recall to your attention is that high productivity, that is, low labor cost per unit of product, is a necessary condition for a high level of employment at high wages. We cannot support high wages without high productivity. This follows directly from the first principle: we can have more only if we produce more.

I would also remind you that current discussion to the effect that a higher wage scale always leads to a higher level of purchasing power overlooks this important relation between wage scale and productivity. A wage scale that is too high can reduce employment and total purchasing power. The level of purchasing power is not determined by the wage scale alone, but by the number of people employed and the wage scale.

American industry has been able to pay the highest wages in the world only because it is the most efficient and productive industry in the world.

A British textile mission from Lancashire recently visited the United States. On its return, this

THE AUTHOR



Mr. Newbury

Frank D. Newbury, present vice-president of the Westinghouse Electric and Manufacturing Company, began his career with that company as an apprentice engineer. He has held such positions as section engineer, executive engineer, and general manager of Machinery Engineering. In 1940 he was appointed to the important position of manager of the Emergency Products Division. The next year he was made vice-president of the company.

Mr. Newbury began his career in Engineering as a student at Cornell University. He was editor of the Sibley Journal of Engineering and was elected to the honorary scientific society of Sigma Xi. He graduated from Cornell in 1901 as a Mechanical Engineer and immediately entered the employ of the Westinghouse Company.

British mission reported that 95% of the looms in the United States are automatic looms, and 5% of the looms in Great Britain are automatic looms. British spinners produce 51% to 72% of the American production per man-hour; British weavers produce only 1/3 to 1/2 the output of an American weaver in the same time.

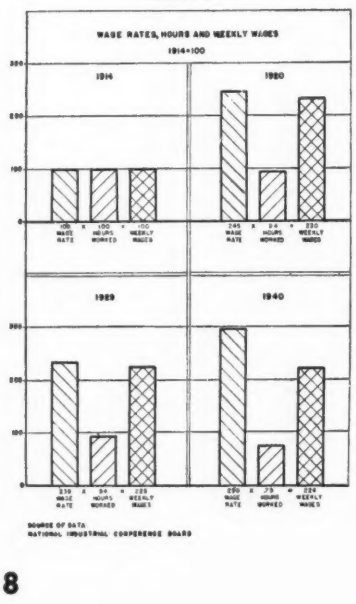
British Opinion

The Economist, of London, is now publishing a significant series of articles entitled "A Policy of Wealth." These articles stress the need for doubling the productivity of British manufacturing within the next thirty years, if British industry is to provide the higher standard of living the British people expect; and, *The Economist* says, this is not an impossible goal because, if it is reached, British industry will be no more productive per man-hour in 1974 than American industry is today.

We all know that American manufacturing industry has increased in size, in number of jobs, in the total wages and salaries fund, and throughout its long history the trend of wages has been upward, working hours have declined, and for many manufactured products a better product has been sold at a lower price.

These facts are well known; but the reasons why high wages can be paid, and the reasons why still higher wages may slow up and reverse this expanding employment and actually reduce employment and income are not so well known. Suppose we try to look at some of these internal relationships that relate wage scales to employment.

Chart I



Total labor cost—the product of wage rates and hours required for a given result—is the vital factor in employment. Common experience shows that we can pay high labor rates and have low labor cost if efficiency is high. If this product of wage rate and hours, resulting in unit labor cost, is kept low, the fundamental relationships of industry that determine volume of employment are not changed. If it is assumed, for example, that higher labor rates are balanced by greater efficiency, that is, if the product of wage rate and hours worked per unit is not increased, the same labor force, working the same hours but working more effectively, produces more goods. National product, national income, and the total wage and salary fund are all increased correspondingly. Therefore, the same labor force can continue to be employed at higher wages because more was produced. The labor equation remains in balance, and the national income relations have not been changed.

Opposite Condition

Suppose we clinch this point by looking at the opposite condition. Suppose we assume that wage rates are increased without any increase in efficiency of production, nor any increase in selling prices. Under these assumptions it is obvious that the labor cost of a given national product is increased and that either of two things must happen: either the increased labor cost must come out of some other part of the national income, thereby reducing some other share; or fewer workers can be employed at the higher rates from the same total wage and salary payments. This has the additional effect of reducing the total national production and the vital national income so that everyone suffers. Higher labor rates, higher than justified by increased productivity, may cause mass unemployment. I believe this was one of the major causes of the long-continued mass unemployment during the 1930's.

There is another way, other than by increased productivity, by which a balance can be struck among wage scales, volume of employment, and national income. This is by the easy way of higher market prices. The Total National Income and the Total Wage and Salary Fund are increased when the average price level is increased, if the higher prices do not operate to decrease customer demand. Under this assumption, the total employment can remain the same in spite of the higher wage scale, and the larger wage and salary fund can be provided out of the larger National income, without upsetting other shares and other interests.

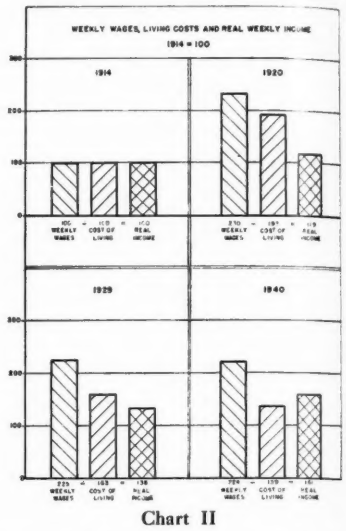


Chart II

Uneven Assets

If all wage and salary scales and other income payments could be increased in the same ratio and all prices could also be increased in the same ratio, everyone would be as well off as before, but not better off. In practice this is impossible, and price increases to offset limited wage and salary increases, to special classes of workers, always work hardships to other groups. In all of these discussions it should be remembered that workers in the manufacturing, mining, and construction industries, who are most active and successful in seeking wage increases, comprise only about 30% of the total working force, and the other 70% usually suffers in real income, if the 30% receives more than they really earn.

There is a strong feeling in labor circles that labor does not now receive its fair share of total income; and that the withholding of large

business profits, either paid out as dividends or retained in the business as additional capital, is the reason for this unfair treatment of labor. This is one of the emotional aspects of the wage-scale problem that makes wage negotiations so difficult, but management should recognize and meet this feeling with the facts at every opportunity. This deep-seated belief will lead to reject the principle that wage scales can be increased only as fast as productivity is increased, because they believe the funds are now available, but are diverted into profits instead of into wages and salaries.

Comprehensive Picture

This opinion that labor is treated unfairly is usually met by management by showing, for the single corporation concerned or for a large group of corporations, that total profits are not large in comparison with total payroll expenditures. I would like to present a still more comprehensive picture based on the accepted estimates of national income figures, compiled by the Department of Commerce.

If we look at the figures for Total National Product for three significant peace-time years—1929, 1932, and 1940—we find that Total Wages and Salaries paid amounted

Westinghouse old type 5 HP, 4 pole AC induction motor.

to:

53.3% of Total National Product in 1929,
57.2% of Total National Product in 1932, and
54.1% of Total National Product in 1940.

Throughout this period, including the boom year of 1929, the depression year of 1932, and the moderately good year of 1940, the share of total product paid out in wages and salaries remained about the same, and the share in 1932 was greater than in 1929 or 1940.

Suppose we now look at corporate profits, both profits paid out as dividends and surplus retained by the corporations. In these same three years total profits were:

1929 plus 7.2% of Total Product,
1932 minus 6.5% of Total Product, and
1940 plus 6.0% of Total Product.

Here we see wide fluctuations between good and bad years.

The same general stability in the share of wages and salaries is shown by the national income estimates made by Simon Kuznets of the National Bureau of Economic Research, which go back to 1919.

Suppose we look at Corporate Savings retained, using the Department of Commerce estimates.

For the 15 years, 1929 to 1943 inclusive, this item was a deficit item of 8.8. billion dollars; this was a withdrawal of funds from past earnings, to pay current payroll and other costs.

Certainly, there is no fund, here, from which to draw on for larger wage and salary payments.

Incidentally, during nine years of these 15, in which deficit withdrawals were made by corporations, 25.6 billions was paid out more than was earned; during the same nine years the Federal Government paid out 17 billion dollars more than was collected in taxes, only two-thirds as much. American corporations were the real super-Santa Claus of the depression, strange as it may seem!

Two Conclusions

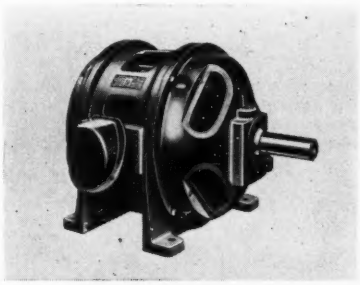
I believe we can logically draw two conclusions from these figures that are also supported by general experience:

(1) Higher wage scales have not appreciably increased the employees' share of total national product.

(2) The total wage and salary fund can be increased substantially only by increasing total national production and total national income. All of us gain together, or all of us lose together!

If this statistical evidence is accepted, it means that all the pressure for higher wage rates, exerted by law and by labor unions, has had only a negligible effect on the share of the Total National Income that goes into wages and salaries because fewer people receive the higher wages.

It should be reassuring to employees, to labor-union management, and to employers alike that during this period—through prosperity and depression—the total wages and salaries paid out have, over the years, constituted a surprisingly constant and predominating share of the national income and national product.



Modern 5 HP open ball bearing Westinghouse motor is half the size the old type.

It seems to me that it is a reasonable conclusion that this approximately constant share represents a fair division of total income, because it is the resultant of all the competitive, economic forces, and interests present. And it is clear that there must be economic forces present that are stronger than bargaining power or selfish interests. At least all of these different forces have balanced out at approximately the same result year after year. We all gain much more from efforts to increase the total national product, than from efforts to change the distribution.

In the practical operations of industry the benefits of increased productivity and industrial efficiency have not been used entirely for higher wages; these savings are used also to shorten working hours and to reduce market prices, as well. This distribution has been made in the past, through familiar bargaining methods, and by the step-by-step adjustments between costs and market prices that are continually going on.

Let me illustrate the results of

(Continued on page 24)

A QUARTER CENTURY OF ENGINEERING RETROSPECT

By PROFESSOR L. D. DOTY

THE tendency toward old age in any individual is in direct proportion to the amount of time said person "lives in the past". I did not realize that antiquity was creeping in, until unconsciously (a word all pedagogues should abhor) slipping into some "I remember when's" while just recently discussing a mutual interest problem with M.E. and E.E. friends. Of course, a C.E. never grows old and the only thing that ultimately takes him is the final acknowledgement that death is one of the forces of nature for which he just failed to figure the proper moment. Then too, the Ch.E's have their catalytic agents that get them around the Diety and "Dusty" Rhodes, so their's is the kingdom of eternal youth. The E.E.'s may get themselves projected into the infinite with radar, and any M.E. who has survived Dr. Goodier's course on "vibrations" can integrate formulae of leger-de-main which will call the proper spirit at the proper time—all without audible "burp". Now just think back. Did you ever meet up with an engineer who wasn't right in his prime of life? Mortician engineers—the term "engineer" is becoming broadly used nowadays and what job isn't an "applied science"—are the only possible dissenters. Some of the V-12ers taking NCE-6 upon heaving themselves up the "ladders" from the "bilge" (many direct similarities) of the hydraulic lab, remark that they "ain't-what-they-uster-be" back in their scout days. This vertical distance, by the way, is 78.632 feet. At least that's what the unfortunate original group of NCE-6'ers determined and the figure has been carefully handed down through report-posterity. (Prof. Bogema is instigating a project to change the crest height of Beebe Lake dam so beware you NCE6ers. who rely upon the gage readings and computations of others.) All of this highly involved meandering is by way of saying there is no admission of old age on the part of the writer of this epistle or of the reader, if he has survived as such to this point.

Conditioning

Anyway, when I entered the cloisters of higher learning, just twenty-four years ago—a bald admission of 4.167% error in the title—I took up with other freshmen the genteel art of plane surveying. The hardened experienced surveyors in the class i.e. those fellows who had worked with a surveying gang (more modern nomenclature is "party"), instilled into us neophytes that good accurate work was dependent mostly upon one's ability at tobacco chewing. We found the chewing the easiest part. The ability involved was eliminating the effluent (those in CE 252 please check term) with the proper "thwerp," and coordinating same with the calling off of readings from transit limb (no co-eds graced our gangs then) or tape. Accuracy of expectoration was soon developed to the degree that positions to hold the rod, place the chain pin, or mark a reference point, could be deftly indicated. One really old timer related the experience of having warded off a coiled rattle snake just ready to strike (while he had both hands engaged in plumbing over a point) with a well directed "shot". Yes, "accuracy" and "per cent of error" had a broader meaning in those days.

Nomenclature definitely had to

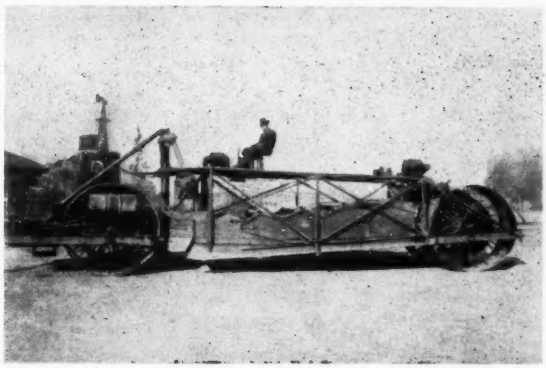
THE AUTHOR

Professor L. Donald Doty received a B.S. degree in 1925 from Denison University where he majored in Civil Engineering. He was awarded an M.S. in C.E. at the University of Illinois in 1933, and a C.E. professional degree in 1937. When he came to Cornell in 1942, his professional experience included four years of university teaching and eight years of flood control work.

Societies which Prof. Doty belongs to include the S.P.E.E., the American Military Engineers and the American Geophysics Union. An account of his flood control experience with the U. S. Corps of Engineers appeared in the Cornell Engineer in October, 1943.

Prof. Doty

Today's big rubber-tired Tournapull in operation. This unit excavates its own load with the aid of a pusher tractor, hauls at speeds up to 14.9 m.p.h., and spreads its own load—all in one continuous cycle of operation.



Forerunner of today's Tournapull, the first self-propelled scraper unit built by LeTourneau in 1923 had steel-spoked disc wheels, five telescoping buckets, seven electric motors, a twenty yard capacity and a top travel speed of about one mile per hour.

be tough. The transit or the level was the "gun" and the slide rule (a very intricate affair called the "polyphase duplex" had just come on the market) was called the "slip stick". The embryo M.E. lab students were sent from one building to another to borrow a "left-handed monkey wrench" required in assembly of experimental equipment. The E.E.'s had their "sky-hooks" and the Ch.E's were still pure chemists who hadn't yet lowered themselves to an engineering status.

This toughness stemmed from the inherent desire on the part of student and practitioner alike to lick the forces of nature into absolute control with the bare fists if need be. Such esprit-de-corps was carried down the years with the song directly exemplifying Georgia Tech men, but secretly thrilling to all student engineers who sang:

I'm a ramblin wreck from Georgia Tech,
And a Hell-of-a engineer;
A Hell-of-a, Hell-of-a, Hell-of-a, Hell-of-a
Hell-Of-An-Engineer.
Like all good jolly fellows,
We take our whiskey clear.
I'm a ramblin' wreck from Georgia Tech.
And a Hell-of-an Engineer.

There were, of course, many unprintable parodies that rivaled "Mademoselle from Armentieres." Now these engineers had a most enjoyable time in their studies and practice. The C.E.'s used the language of teamsters. The universal one yard automatic dump wagon and team was still in general use). The M.E.'s used the terms of a cross-roads blacksmith auto mechanic and the E.E.'s reveled in a lineman's specially constructed profanity. The Chems dashed good five cent test tubes to the floor in fits of anger. Oh yes, "they was all brothers in that Great Fra-tah-nity." Tough hombres these, that could lick a job to downright submission. Then bring on the next project!

Uncouth Group

But there was something lacking in the rounded life accomplishments of this uncouth group of would-be professionals. Their trends were clannish and almost anti-social. How could their acquired mannerisms admit them to active work in a church (the walls would fall in if any engineer in a weak moment should so much as enter) or a civic club? They were "doers" not "planners". They "went places" personally, but rarely professionally. Business and industry paid them a bare living, for these men "loved their work" and the employer treated them kindly, just as he would any good work horse. Engineers were altogether by-passed when promotion to executive positions were made, because they hadn't the "broader vision" so necessary in real business developments. They were indeed left to more-or-less stew in their own tobacco juice.

Romper Stage

Now no individual engineer is going to admit that he belonged to the above outlined ilk, but he knew a lot of professional (?) associates that did. To be sure each division of engineering has had outstanding professional individuals. These men pointed the way, but the rank-and-file following wasn't so clear-cut.

To be recognized as a profession the group so concerned must be made up of professional individuals. Engineering is one of the newest professions and it has had a long pull to get out of its swaddling clothes. Even now it is not much past the romper stage. Just what are professional individuals like? "What'a they got that we ain't got?" Engineers knew a lot of supposedly professional individuals that they did not particularly want to imitate. It so happened that during the last quarter of a century this young profession has undergone a profound metamorphysis wherein the various divisions have been literally lifting themselves by their own boot straps out of the quagmire of pseudo-professionalism.

Professionalism

Professionalism involves not only high standards of specialization but also broad understanding of its application. It cannot be narrow in any way. It includes ethical behavior and humanitarian understanding. It has sociological interests, and is charged with advancing the general well-being of mankind. How closely all of our technological endeavors are associated with these attributes. Why do we build highways, high tension transmission lines, more comfortable automobiles, and plastic fountain pens? Well, these are built because the individual, corporation, or government agency involved directed that it be done. It is necessary that individuals work through organizations in order that the project be properly accomplished. Why does

(*Continued on page* 25)

A HUNDRED HELICOPTERS

By CHARLES C. HANSEN, ME '46, V-12

Editor-in-Chief, The Cornell Engineer

IMAGINATIVE designers and inventors have been having a field day on helicopters for the past five years. Eighty or a hundred helicopters of varying design were built or projected in this country alone as part of the helicopter boom which began when Sikorsky's VS-300 first took to the air in an awkward take-off, hovering, and landing, back in 1940. Unimpressive as that conglomeration of tubing, motor, and blades may have looked, it was a truly climactic point in the five hundred years of helicopter history since they were first thought about in 1473.

Following Sikorsky's success, inventors began dusting off their drawing boards and sharpening their pencils, unhampered by basic patents, which had expired since their issue twenty or thirty years before. The investors, close associates of the inventors, began dusting off the securities in their safety deposit boxes because long-dreamed-of helicopters looked financially rather promising.

New Designs

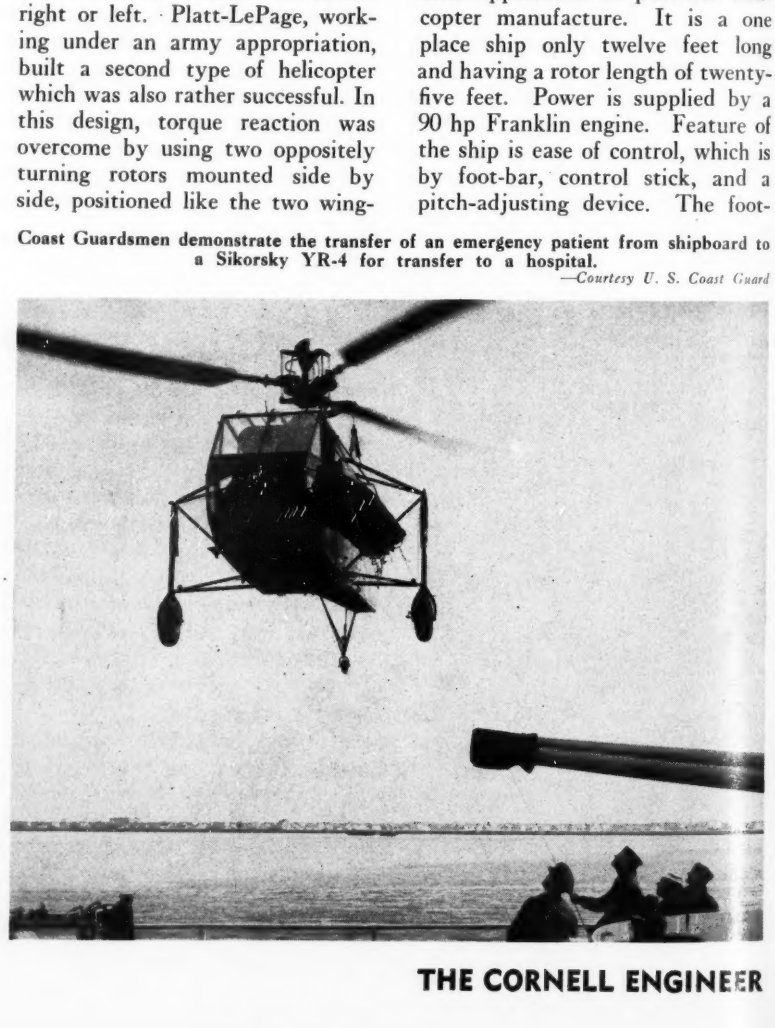
New helicopter designs began to appear all over the country. Strange thing about them was the fact that most were radically different from each other. After inventors had been struggling for years to produce a successful flying helicopter, Sikorsky finally accomplished the feat with one distinctive type of design; almost immediately other successful designs appeared, indicating that Igor Sikorsky had won the helicopter race by a very slim margin.

The hundred-odd design types of today could probably be divided into three main classes. Sikorsky's planes used a single, large, three bladed rotor which was tiltable for forward motion. The torque reaction of the rotor shaft on the fuselage (which would tend to spin the fuselage around) was counteracted by a smaller propeller operating in a vertical plane in the position normally occupied by the rudder of a conventional airplane. By regulating the speed of the torque-reaction rotor, the ship could be held in a fixed orientation or turned right or left. Platt-LePage, working under an army appropriation, built a second type of helicopter which was also rather successful. In this design, torque reaction was overcome by using two oppositely turning rotors mounted side by side, positioned like the two wing-halves of a monoplane. Nineteen year old Stanley Hiller, Jr. designed a successful ship of the third important type, which featured two co-axial rotors mounted one above another, turning in opposite directions.

Hiller-copter

Features of this latter craft, named the Hiller-copter, along with other ideas of Hiller, have been purchased by Henry Kaiser for possible application to post-war helicopter manufacture. It is a one place ship only twelve feet long and having a rotor length of twenty-five feet. Power is supplied by a 90 hp Franklin engine. Feature of the ship is ease of control, which is by foot-bar, control stick, and a pitch-adjusting device. The foot-

Coast Guardsmen demonstrate the transfer of an emergency patient from shipboard to a Sikorsky YR-4 for transfer to a hospital.
—Courtesy U. S. Coast Guard



The Army-Sikorsky helicopter lands on the deck of a tanker in Long Island Sound.

bar controls turning to left or right, the control stick tips the main rotor to give forward or sideways motion, and the pitch-adjusting device controls rate of climb.

Second helicopter to be flown after Sikorsky's was the two-place Platt-LePage XR-1A, using two laterally mounted rotors spun by a powerful 450 hp Pratt and Whitney engine. Makers of the Platt-LePage also have designs for an eight-passenger utility ship and a fourteen passenger transport using a twin-motor, twin-rotor set up. Another helicopter of this type is the 2-place Schouw H-100, which is of all metal construction and equipped with dual controls and a parachute—just in case the auto rotation does not work.

Sikorsky

Most helicopter designs, however, are similar to Sikorsky's, having both a main rotor and a torque-reaction tail rotor. Ever since Sikorsky became interested in aviation, he has been partial to helicopters. At the age of twenty-one, he built a flying model, rotary wing ship. He was unable to solve many of the problems which arose in the design of a full-sized ship, largely because of the lack of efficient propellors and lightweight engines; it was not until 1930 that he patented some of his helicopter ideas. In 1939 he started development of the VS-300. Since its success, he has developed the YR-4, which uses a 180 hp engine to lift its gross weight of more than a ton at a rate of 10 mph upward. Its maximum forward speed is 82 mph, and construction is of heavy gauge steel tubing with welded joints. The 48 foot diameter of the three-bladed YR5 rotor is the largest ever used for a helicopter and is powered by a 450 hp Pratt and Whitney engine. The YR6 has a forward speed of 100 mph and is able to carry either bomb racks or a litter on each side of the fuselage for evacuating wounded.

Bell Aircraft

Bell Aircraft's helicopter uses a two-bladed rotor with a device which tries to answer the stability problem by rendering the rotor free of the mast and so allowing it to remain in a horizontal plane. This ship is to be produced solely for military and commercial use.

Not to be outdone by Kaiser, Higgins has a two place ship, intended for private civilian use, which is claimed to be entirely vibrationless. They are planning a six passenger plane having a 250-mile range.

Other Designs

Frank Piasecki's PV is a small one-place job featuring a three bladed rotor which folds backwards, enabling storage in an automobile garage.

Besides these, there are many other helicopter designs. Most of them are seeking to take advantage of the inherent good features of a helicopter, such as landing and hovering abilities; however, there are also many inherent bad features in present production designs which must definitely be solved before the helicopter will be a fast-selling vehicle. For example, when the rotor is going, there exists a tremendous amount of vibration. Added to this is the problem of noise, since in most designs the pilot sits directly in front of the engine. Controls are generally complicated and require skilled manipulation; and, if the engines fail at under 300 feet, the pilot had better have all-coverage insurance because by the time the automatic clutch declutches the rotor for autorotation, the ship will have hit the ground. Lack of deicing equipment limits the safe ceiling to about 5000 ft. The helicopter will not hover at an altitude of more than 1000 ft., limiting performance on high-level airports.

Cost is another great drawback at present. *Flying Aces* magazine

(*Continued on page* 36)

Nineteen year old Stanley Hiller, Jr., designed the Hillcopter, which features co-axial rotors turning in opposite directions.

Engineering At Cornell

6. Civil Engineering Laboratories

By ADAM PAUL FRIEDERICH, CE '46

EACH school has its own particularly formidable course. In the School of Civil Engineering it is Hydraulics 240, innocently described in the Engineering catalogue as "required of all Civil Engineering juniors, credit 4 hours, 3 recitations and one laboratory a week." It is often used for a comparison with other courses, even by faculty members, several of whom begin the year with the comment "This is an easy course, and I don't expect you to repeat it as they do in Hydraulics."

The Hydraulics Laboratory under Beebe Lake.

In addition to Hydraulics 240, the school also gives a course in Fluid Mechanics, which is hydraulics modified for Mechanical and Electrical engineers. Both courses consist mainly of hydraulic fundamentals such as hydrostatic pressure computations, flow over weirs, and flow through simple, looping, branching, and compound pipes.

Classwork

Classwork in Hydraulics 240, taught by Professor Ernest W. Schoder, Professor of Experimental Hydraulics and head of the department, and Professor Marvin Bogema, deals with the theory and methods of computation of hydraulic problems. Every week or two a check on the students' progress is obtained by what often amounts to a "Rube Goldberg" quiz. Last year's students still talk about the one in which they made the apparently logical assumption that water would flow down from a closed tank into an open tank with an outlet (and an arrow indicating outward flow) at its bottom. The next period they were told, much to their annoyance, that the water flowed *in* the outlet and *up* into the tank. The quarterly prelims and the final, from which there are no exemptions, are nothing more than collections of these quiz problems, and are designed to make students' averages head for the nether regions. The classwork is taken quite seriously by the students as there is a great deal to cover in only one term of three periods a week. Most of the humor in class is derived from students' mistakes and from banter between professor and students on the subjects of exams. Homework, supposedly worked daily, is collected quarterly, before each prelim. This usually results in the students working all night before the exam catching up on the month's problems.

The Weekly Lab

In the weekly lab period, the students have an opportunity to actually make the measurements and collect the data for making the computations they have learned in class. Except for the first two weeks, which are introductory and deal with the method of logarithmic plotting, the lab sections meet in the Hydraulics Laboratory at Triphammer Falls. Few booklets published about the University fail to mention the Hydraulics Laboratory, picturesquely situated in the gorge at the foot of the falls. The student usually hears a different story about the lab from upperclassmen who dote on worrying freshmen and sophomores with tales of this cold, dank building with its maze of pipes and valves, and the torturously twisting stairway "about a half-mile high."

Actually the Laboratory building

is eighty feet high and is built of stone to blend with the cliff which forms the rear wall. Inside, the maze of piping contributes to making the lab an excellent, although inconvenient, place for instruction and experimentation. The Laboratory was built in 1898 under the direction of Dr. E. A. Fuertes, then director of the Civil Engineering School.

Before this extensive building was put into operation, hydraulics was taught in the south end of the basement of Lincoln Hall. Water was supplied from a tank on the fourth floor, and, when long pipes were necessary, they were often laid along the length of the hallway.

The Original Lab

The first Laboratory in Triphammer gorge was a single story stone building at the base of the cliff. A six foot standpipe projected through the roof, rose fifty feet, then bent at a right angle to connect with the canal through a concrete collar.

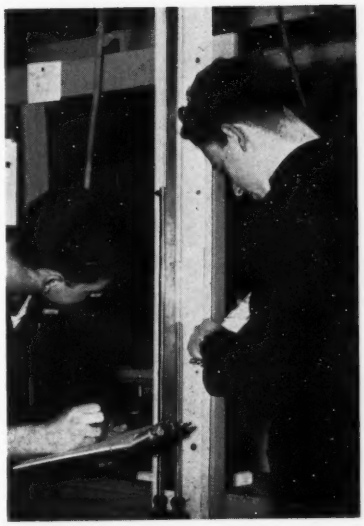
This sixteen foot wide canal was designed for studying the flow of water in large open channels, although, for a time, it supplied the lab with water through the standpipe. Located next to the Laboratory at the southern end of Beebe Lake dam, it is about 200 feet long with nearly 100 feet roofed over. Recently a complete model of the Chenango River, including tributary entrances, bridges, and retaining walls was set up in the canal for flood control studies.

Several years after the construction of the original building in the gorge, ice, from the spray of the falls, which collected on the standpipe and roof of the lab caused so much difficulty that the building was extended to its present height —reaching to the top of the gorge. This change also made it possible to greatly enlarge the facilities of the Laboratory.

Present Set-up

Water is now taken from just above the dam and is led through a pipe to an open channel in the top of the Laboratory. At the end of this channel is a weir for measuring the rate of flow and a diverter constructed by Professor Schoder to direct the water into either a waste pipe or the six foot standpipe from which water is obtained throughout the lower laboratory. In addition to supplying water this channel is used for small scale river control studies, similar to those made several years ago on the shape of the Rochester Gas and Electric Company dam on the Genessee at Mount Morris.

Because of the large range of possible heads and quantities available, the Laboratory is ideal for research on all sizes of pipes and machinery. Recently a Venturi meter of 42 inch diameter, one of the largest in the country, was tested and calibrated in the lab.



Manometers must be read to 0.001 feet. *—Photo by Knight*

Near the Laboratory is a wooden building, part of which serves as a lecture room, the rest being a small machine shop for building and repairing research and demonstration apparatus. The lecture room is supplied with water from the University mains and is used for such small scale experiments as jet trajectory, flow through orifices, and buoyancy demonstrations.

Hydraulics Option

In addition to the two courses already mentioned, the Hydraulics Department also has charge of some of the courses given for the Hydraulics Option of the School of Civil Engineering. If a student decides to specialize in hydraulics and elects this Option, he must take such courses as Hydraulic Measurements, an experimental course involving current meters, Pitot tubes, Venturi meters, orifices, and other methods of measuring hydraulic properties. The Department also offers a course for this Option in Advanced Hydraulics which carries further the studies pursued in Hydraulics 240.

Whether or not a student elects the Hydraulic Option, however, he uses the knowledge of the basic principles of hydraulics which are introduced in course 240, in other required and elective courses as water supply, sewerage treatment, water power, and hydraulic construction which round out a Cornell Engineer's education.

Taking data in a very busy corner.

PROMINENT

Chris

Paul Christensen, AE '46

WATCHING Paul Christensen put away half a dozen sandwiches in half an hour you suspect he is a capable man, and he is.

"Chris", as his friends call him, enrolled as a freshman in the fall of '42, in the Administrative Engineering Course, and as he puts it, "It's Pop's fault, not mine." But now that most of the labs are over, he admits it wasn't such a bad idea.

During his freshman year he was elected Life Secretary of the class of '46 and got his start on the Student Council. After being active in it for three years he was elected president last term and has helped rebuild it into the very active organization it was before the war.

Chris already has big plans for some '46 reunions after the war. Since the civilian class will be combined with many V-12 trainees, they ought to be really big. The first get-together should come within two years after V-Day, and then they will hit a five year frequency. Financially, the class is comfortably situated right now, as a result of the success of a recent dance, but like a true class secretary Chris is always on the lookout for new methods to build up the treasury.

To some people all these other activities might be enough, but not Chris. Where he found the time is still a mystery, but he won his Major C in track his junior year as a dash man, and is now shooting for a watch at the Penn Relays this Spring. He is also a member of Spiked Shoe, the honorary track society. Through this contact with athletics he was appointed to the Board of Physical Education and Athletics as one of the two student members.

Still finding himself bored with all his spare time, he took on the job as chairman of the Spring Day Dance in '44, and although he admits he enjoyed it he claims he'll never look at another job like it. Along with all his other activities, Paul also found time to serve on the Student Conduct Committee.

Chris pledged Beta Theta Pi his first week at Cornell, and ever since then he's had an unrivaled interest in parties. His piano playing has kept many a party rolling into the wee hours of the morning. In keeping with his party spirit he is also a loyal member of Beta Upsilon and Pi Beta Tau and has done his best in upholding their traditions.

After he graduates this June, Chris's post-college days will be taken care of by the Navy for several years. When he gets through Midshipman school he wants submarine duty, and after the war he thinks that taking a night school law course would complete the education he wants. For although it's an unusual ambition for an engineer he wants to try corporation law.

George H. Bailey, ME '46

ONE of the happy group of Princetonians who embarked for Cornell V-12 on the special train from Hoboken on July 1, 1943 was George Howe Bailey. He didn't know much about Cornell, and the prospects of launching into electrical engineering at a new school looked rather questionable. George, however, took it all in his stride, "saw the light," and switched to the mechanical engineeing school before much time had elapsed.

That first term of V-12 was rather rough on everyone, and George says Nicky Bawlf did little to make it any easier for him on the soccer field. Both being men of conviction, they evidently differed on a point or two. one of which was the question of who educated the Bailey toe. It seems that Nicky claims he taught George everything he knows, while the facts speak for themselves that he had a good deal of experience elsewhere. In spite of the fact that he grew up in the shadows of Grant's tomb and the Riverside Church in New York City, he became quite versatile at booting in the Horace Mann School, being on the All-City soccer team there for two years.

At Princeton George took basic engineering as well as frequent trips to New York. He did little to continue the schooling of his feet, but rather exercised his vocal chords by singing second bass in the University choir.

In Ithaca George has become known as "the boy with the million dollar feet." In spite of his leanings toward bigger and better parties, he managed to stay in training enough to be center forward on the varsity soccer team for the past two years, second-string All-American last fall, and high scorer on the team for both seasons. He is an undergraduate member of the Athletic Board and Committee on Athletic Awards and was assistant basketball manager this past winter.

Very conscientious about his work, George is aiming for a BME degree in June, and in spite of Mr. Bawlf's references to his being "dumb," he is one of the elder un-

(*Continued on page* 44)

George

ENGINEERS

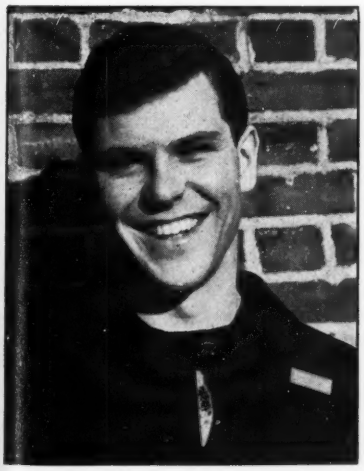
Bud Riehl, ME '46

Bud Riehl, Princeton's contribution to the Cornell V-12 unit, arrived in Ithaca with the first navy contingent in July of 1943. Known to his friends as "smaller than me" he nevertheless has made his mark in practically every walk of Cornell life.

Our hero hails from Erie, Pennsylvania, where he developed his love for his two favorite sports, swimming and sailing. He graduated in 1941 from Strong Vincent High where he distinguished himself as senior-class president and holder of the state 440-yard swim record. From here he proceeded to Mercersburg Academy where he became an important cog on their interscholastic swimming team. In June of 1942 Bud entered the Princeton Engineering school. At "Old Nassau" he added another record to his swimming laurels and became most proficient in the art of chug-a-lugging beer (in off season). In addition, he took an active part on the Orange Key organization.

At the request of Uncle Sam, Bud placed his extensive wardrobe in storage and donned his gob suit. At Cornell he continued to follow his hobbies of swimming and sailing, becoming captain and mainstay of the undefeated Big Red swimming team, and Vice-Commodore of the Cornell Corinthian Yacht Club. He continued in his disregard for swimming records by shattering the Cornell pool 440-yard swim mark.

Bud



An undefeated swimming season is bound to carry more than its share of thrills, especially when you're swimming against teams like Columbia and Sampson. Winning the second Sampson meet of this past season gave Bud his biggest thrill at Cornell. Earlier in the season Cornell had eked out a decision by winning the final relay. Sampson sought to regain prestige by snapping Cornell's long winning streak of 20 victories with their strength bolstered by the addition of several nationally known swimmers. Bud's thrill came in the 440-yard freestyle race when he assured his team of victory by defeating McCarthy, Michigan's star of the '43-'44 season, and Tresnak, former national champion.

Last fall Bud became one of the first men to be elected to membership on the Cornell Student Council by popular vote of the Navy men. His work on the Student Council has been characterized by his inherent ability and genuine interest in this type of activity. His Pepsodent smile and winning ways have often served the Council well in gaining the support of WSGA.

Unlike most students, Bud did not select an engineering curricula because of any technical aptitude or desire, but as a background for tax and corporation law. Ever since he started high school the ambition to become a lawyer has been foremost in his mind. A very convincing speaker, he has become adroit in persuading his friends without their knowledge or resentment that his way is best. He is equally at home in a bull session or on the debating floor, the former usually holding full sway in his own room much to the dismay of his more eager roommates.

Upon the expiration of his sojourn with the Navy, Bud plans to attend law school, but his immediate future is in the hands of the Admirals.

Don

Donald R. Pierce, Arch '46

L'ogive is an old French word which, when looked up in Cestre-Guibillon Dictionnarie (Francais-Anglais; Anglais-Francais) is translated as "ogive, f." The meaning is therefore a little obscure to the layman; but to an architect its connotations are complete. It is customary for engineers to organize societies "for the advancement of ——— Engineering," and then let them on the side (sub rosa) degenerate into a party group; but it is left for the architects to start out with a society for fun, the original party society.

Yet Architecture is not all fun, but has plenty of hard work. And Donald Ripley Pierce is among those members of L'Ogive who can be found hard at work in the drafting room on top of White Hall, afternoon and night. Don, a Tau Beta Pi member, is another of those architects who have found it easy to walk across the Quadrangle to Lincoln Hall and get good marks in C.E. courses as well.

Don, who hails from Palmerton, Pa., came to Cornell in 1942 to attend the Ag School, but Architecture attracted him and he is now sold on it completely. "Decided to make Architecture my profession," he says, "and have been getting more and more interested in it ever since." Architecture has pretty well filled Don's life these past few years, and what time not taken up in his work has been purloined by the Navy. But Don has found time to become a member of the Varsity Crew these past three seasons and

(*Continued on page* 44)

NEWS OF THE COLLEGE

Pyramid

NEWLY elected members of Pyramid Society, are the following:

Gordon Chester
John Collinson
John Gnaedinger
Jack Hardy
Jim Moore
Warren Houck
Ed McDonough
Salvador Rullan
Pete Verna
Pete Vivoli

Following the March initiation, new officers were elected:

President, Cal Brown
Vice-president, Roland P. Allen
Secretary-Treasurer, John Gnaedinger

At regularly scheduled Pyramid meetings, members give speeches on topics of their own selection, either technical or non-technical, aimed to broaden the scope of the organization. At a recent meeting plans were also made for a party to be held during April for all members and pledges.

Size of Cams

AN exact and mathematically correct method of determining the correct shape and minimum size of a cam has been worked out by two members of the faculty, Prof. W. B. Carver of the Mathematics Department, and Bayard E. Quinn, instructor in machine design. Described in a paper just completed by the Cornell mathematicians, the method is exact to at least 100,000th of an inch.

Present methods of determining the shape and minimum size of the cam are based on drawings which involve a certain amount of trial-and-error method. The new method consists of using mathematical equations to determine the minimum radius of the cam, and to find the closed curve which just touches the follower (the bar or rod, the end of which rides on the cam and thus determines the action of a machine) as the follower goes through all of the desired positions during one revolution of the cam.

Absenteeism

THE fact that a war plant worker has close relatives in the war does lessen unnecessary absenteeism, but is not so important as "in-shop" considerations, according to a study made recently by E. W. Noland, assistant professor in sociology, Cornell University. He bases his findings on hundreds of unsigned questionnaires from employees in a war industry with less than 1500 workers.

"In-shop" considerations, such as satisfaction with one's job, healthy opinions on the part of workers regarding efficiency and attitudes of management, were found to be most influential of all in keeping absenteeism down.

Other contributing factors, Dr. Noland finds, are home life, comfort on the job, life organization (including morale), and community attitudes.

Illness, contrary to general belief, accounts for only 31.7% of the absences studied in this survey.

The following do not seem to affect absenteeism: sex of worker, marital status, extent of support given family during childhood, age when starting to work away from home, distance from home to the plant, length of employment in present job.

Much remains to be done to encourage better attendance for patriotic reasons, especially among those not having relatives in the armed forces; displaying posters, distributing shop communiques, conducting special drives are suggested. Young people, interestingly enough, have slightly better work records than those farther beyond draft age.

Those having the best attendance records have larger families, have stayed at former jobs for some length of time, spend but little time outside working on other jobs.

Atmos

ATMOS, honorary Mechanical Engineering Society, initiated the following on Saturday night, March 17:

Professor L. T. Wright
Mac Adams
Roger Allen
Bill Barr
Roy Bergen
Al Brede
Bob Burgess
Dick Goll
Chuck Hansen
Arnold Page
Fred Yarrington

The initiation was followed by a party in honor of the new initiates, chaperoned by Professors George Lee and L. T. Wright, and their wives.

Al Djebar

THE following men were elected to Al Djebar:

J. K. Davidson
Malcolm Hecht

The former was initiated on Sunday, March 18, by the installing officers, Bryce MacDonald, President, and P. T. Atteridg, Secretary. The initiation was followed by a beer party at Alpha Chi Sigma and a picnic in Cayuga Heights.

Rod and Bob

AT a recent meeting Rod and Bob elected the following as members:

Tom Fellows
Oscar Fuller
Gil Holmberg
Tom Kylie
Phil Marshall
Don Smith
John Smith

The group is making plans for a party to be held in conjunction with several of the other Engineering societies on May 26, and also for a farewell party in June to be held at Mt. Pleasant in honor of the large proportion of the present members who are leaving then.

ALUMNI NEWS

MALCOLM S. JONES, M.E. '10, *has been assigned to work with the following branches of the Office of Price Administration in Washington, D. C.: grocery products, fruits and vegetables, solid and petroleum fuels, chemicals and drugs, machinery, paper and paper products, rubber, and the rationing department. Jones has been a member of the staff of the Office of Industry Advisory Committees for some time is in the O.P.A. reginal office in Boston, in charge of fuel oil conservation, and in the gasoline rationing department of O.P.A. in Washington, D. C. He was also technical advisory consultant with the Smaller War Plants Corp.*

CONANT VAN BLARCOM '08, former Cornell Superintendent of Buildings and Grounds, has been appointed by the trustees of Western Reserve University to make a study of the entire physical plant of the University from the standpoint of new improvements and additions to the buildings and grounds to be

John L. Collyer, M.E. 17

made within the next 25 years. He will consider the locations, rather than the architecture of the buildings, and will make his plans after consideration of the problems and future plans of the heads of the various schools.

Mr. Van Blarcom has been a builder and mechanical engineer in Cleveland since 1936.

JOHN L. COLLYER M.E. '17, *former Cornell oarsman and a trustee of the University, has been called to Washington to direct the Rubber Bureau in order to increase the production of materials needed in the manufacture of rubber products to balance with synthetic production and manufacturing capacity. President of the B. F. Goodrich Co., Collyer's task is unlike that of the first "rubber czar," William Jeffers, who established the priorities essential to the construction of synthetic plants. Collyer's appointment is scheduled to last three months. His assignment is to tell various government agencies, including the War Production Board, just what he needs and how soon, without going through the channels known as red tape.*

The materials Collyer needs most and those hardest to obtain now are carbon black, rayon cord, cotton cord and fabrics, natural rubber, and bead wire—all needed in greater quantities to meet military demands for more tires and other rubber products.

The "New York Times" reports Mr. Collyer as saying that as a result of continued drain on the country's capacity for manufacturing tires, he could hold out little hope for the motorist confined to an "A" card. For these non-essential tires, he said that the situation would be "critical for months to come."

Separated by the war, the Hillsley twins, CAPT. FREDERIC HILLSLEY A.E., (M.E.) '41, *and* CAPT. JOHN J. HILLSLEY A.E. (M.E.) '41, *were united in their war time activities through the medium of the B-29.*

While ordnance officer with the Second Aircraft Repair Unit (B-29's) on Saipan, Capt. Frederic Hillsley associated with many of the men who trained with his brother at Smoky Hill Army Air Field, Salina, Kansas, and at Peter-

The Hillsley Twins

son Field, Colorado Springs, Colorado, where John was stationed as ordnance officer with the 314th Bomber Wing (B-29's).

At Cornell the twins were honor graduates of the R.O.T.C. They were also members of the swimming team and were elected to Tau Beta Pi, honorary engineering fraternity. Frederic served as president of Tau Beta Pi and was also a member of Phi Kappa Phi, another honorary fraternity. John was president of Sigma Phi Epsilon Fraternity during his senior year.

Commissioned second lieutenants upon graduation, the twins were called into service on August 13, 1941. They were first stationed at Aberdeen Proving Grounds, Md. After a year at Aberdeen, Frederic joined the First Special Service Force, composed of Canadian and American mountain para-ski troops and the twins became separated.

Since being united through the medium of the B-29, the twins have met on several occasions in the Marianas, where both are now sta-

(Continued on page 42)

Cornell University Placement Service

WILLARD STRAIGHT HALL, ITHACA 107 E. 48th ST., NEW YORK CITY

Dedicated to ye ancient and honourable society of ye chemical engineers in ye belief that Chemicale Engineering is ye one, ye only art.

"Caustic"

By JIM EDISON, ChemE, V-12

WE recently learned that an eminent doctor has discovered that the sense of hearing is dulled by eating. This, doubtless, is greater nature's attempt to protect us from after-dinner speakers, and may, or may not, be the reason the senior Chem E's drop into the Co-op for a small snack, enroute to Baker and Chemical Engineering Thermodynamics. Not that we personally have anything against Thermodynamics — we're pretty sure it's here to stay.

Also here to stay, we fear, is the benzene ring theory, so long dear to the hearts of the organic chemists. Surely we don't have to elaborate on the theory itself—even the CE's, in their colossal ignorance of such matters, must be aware of the postulated benzene ring with its six carbon atoms, joined by three single and three double bonds. Every since we took organic and learned that despite the overwhelming evidence in support of this theory, there was some possible doubt, we have thought that perchance we could prove it wrong. In our minds eye we could envision the chaos that such a revelation would cause — textbooks being burned, chemical industries collapsing, Messrs. Fuson and Snyder (*Organic Chemistry*, John Wiley & Sons, 1942) retiring to the farm and raising chickens, Professor Winding trying to rewrite his Plastics and Petroleum notes—but, alas, it was all just a dream.

We read in *Time* where Dr. Maurier L. Huggins, a chemist—it couldn't be a Chem E, it had to be a lowly chemist—at the Eastman Kodak Research Laboratories, has photographed a molecule of hexamethylbenzene, and the photograph agrees perfectly with the chemist's theoretical picture. And there was even a copy of the picture he took published with the article. It's the crowning blow. We tried to argue ourselves into believing that it was just some fly specks on the photographic plate, but no use—we know when we're licked.

Ah well, "the best laid plans of mice and men . . ."

* * *

Captain (at ye olde Captain's Mast): Davis, it seems to me that you've been coming before me every day since V-12 started nearly two years ago.

Davis: So can I help it if you don't get promoted?

* * *

Question: What does a dog do that a man steps in?

Answer: Pants.

(And let that be a lesson to the filthy-minded in our midst.)

* * *

Willy in a fit insane
Thrust his head beneath the train.
All were much surprised to find
How it broadened Willy's mind.

* * *

Old Colored Mammy: "I want a ticket for Magnolia."

Ticket Agent: (After ten minutes of thumbing through railroad guides.) "And where is Magnolia?"

Old Colored Mammy: "She's setten' over there on the bench."

* * *

As one of the boys who used to be in our dorm wrote:

"I just arrived at a certain place, but I can't tell you where. However, I can tell you this much—I just shot a Polar Bear."

"I've been transferred from where I was when I last wrote you," he said in his next letter. "I can't tell you where I am, but I just danced with a Hula Girl."

"I still can't tell you where I am," said the next letter, "but I can tell you this for sure—if I had danced with the Polar Bear and shot the Hula Dancer, I wouldn't be where I am now."

* * *

In one of our last issues, we stated our intention of heading for Texas after the war, despite the fact that Texas "doesn't have anything but sand, desert, Gila monsters, and cactus." Now we meant no slight to the state of Texas, but one of the chiefs on the hill—a loyal Texan from way back—called us into the office and informed us that he wasn't too pleased at this slur on Texas. So we wish to take this opportunity to publicly apologize. We're sorry Chief—we're sorry that Texas doesn't have anything but sand, desert, Gila monsters, and cactus, and we won't mention it anymore.

* * *

We learn in Plastics that postwar gowns may be made of glass. In consequence, we have just about decided to give up Chemical Engineering and go into the ancient and honorable trade of window washing. It looks like a great day ahead.

* * *

There was an old woman
Who lived in a shoe.
She had so many children
She didn't know what to do—
Obviously.

* * *

V-12: "What did the doctor say was the matter with you?"

Second same: "He said that I was suffering from an acute case of indiscretion."

PROFILES

Of Outstanding Alumni

William Littlewood, M.E. '20

AMERICAN Airlines' present Vice-President, in charge of Engineering, is one of several Cornellians who have helped bring about the rapid expansion of aviation in recent years. Receiver of the Wright Brothers Medal in 1935, for outstanding contribution to aviation, Mr. William Littlewood has done much in making this industry a safer and more potent servant of mankind. This has been accomplished through his deep interest and steady devotion to the betterment of airplanes and airplane engines.

Born in New York City on October 21, 1898, William Littlewood lived in the Bronx and Richmond Hill, Long Island, during his boyhood days. His first contact with aviation came in the early 1900's when he attended the first International Air Meet at Belmont Park. The attendance came by the "informal" method of sneaking under the fence with juvenile companions to watch the local flights of such famous operators as Bleriot, Moissant, Curtiss, and the Wright Brothers. Later boyhood aviation ventures included many flying models built from old bamboo screens with paper and silk cloth coverings and rubberband propelled. Other intense activities of early years included the building of rowboats, ice boats, wind wagons, innumerable pushmobiles and crystal radio sets.

He attended New York City's grammar school until 1912, and Richmond Hill High School 1912-16. During summers in high school he lived on the South Shore of Long Island and operated a boat repair business, including engine overhauls and installations. During one season he held a contract for the navigation lighting of upper Jamaica Bay.

After high school graduation in January, Littlewood worked at American Steel & Wire Company and attended Heffley Institute at night, studying advanced mathematics until he entered college in September.

From 1916 through 1920 he attended Sibley College, Cornell University where he played with the University Orchestra four years as first desk cellist, won Sibley prize Junior and Senior years, belonged to Navati Fraternity, was elected to Tau Beta Pi in Junior year as highest Junior. and taught several courses in physics, machine design and mechanics.

While at Cornell, Littlewood worked with Harold Caminez, M.E. '20 on the development and construction of a hydraulic transmission which was later used by Caminez at McCook Field to couple Liberty engines in tandem. This same device has since become the source of development of the Caminez cam engine, in which Littlewood also actively participated.

It was about this time he met Dorthy E. Cushman, B.S. '21, while a "gob" at Cornell in the S.A.T.C. Naval Unit, (then known as the "Saturday Afternoon Tea Club") whom he later married.. In 1920, after graduating, he joined the Niles-Bement-Pond Co., Plainfield, N. J., manufacturers of heavy machine tools, acting as Experimental and Test Engineer.

In 1924 the Plainfield Plant closed and Littlewood joined the Ingersoll-Rand Compay, Phillipsburg, N. J., first as Ass't. Supt. in the Cameron Pump Works and later as Chief Inspector of the Phillipsburg and Easton Plants of the Company. He left Ingersoll-Rand in March 1927 to enter the aircraft engine field of the aviation industry.

As production Manager of the Fairchild-Caminez Engine Corporation he assisted in the engineering development and manufacture of the unique cam engine which was accorded Dept. of Commerce engine type Certificate No. 1. After a very spotted history in-

(*Continued on page 26*)

Mr. Littlewood

Recent Developments In Engineering

Techni-Briefs

Gun Charger

To prevent the failure of aerial machine guns from imperfect rounds of ammunition, General Electric has developed an automatic gun charger for the B-29 Superfortress, P-61 Black Widow, and other new airplanes.

Besides cocking the guns, the new invention recognizes an ammunition failure, helps remove the defective round, and inserts and fires a new round. When a gun continues to jam for about eight successive rounds, showing that the gun is not working as it should, the device prevents further use of that gun.

Acting electrically, these devices replace the need of a gunner who must first determine the source of trouble and then correct it by hand. The use of the charger in these planes has placed an important part in the establishment of their superiority over enemy aircraft.

Flame-Spraying Plastic

The new Du Pont plastic—polythene—may be applied by the flame-spraying method used to apply coatings of metals. Polythene films thus sprayed are tough and highly impermeable and over metal give protection against brines, chemicals and other corrosive agents.

Photolith Film

An important unpublicized service of photographic film in war is the rejuvenation of intricate engineering drawings. Plans produced directly from original pencil drawings are needed by the thousands, for example, at every airport from the Aleutians to Natal, to aid in repair and servicing. Hard usage soon dulls these originals. Draftsmen take about five hours per square foot to "heavy up" such drawings, some of which may total 75 square feet. Now photo-lithographic film is used to make sharp, clear negatives from even badly worn originals. Positives are then made in quantity requiring no hand-re-inking or checking for accuracy—a tremendous saving in man hours of labor.

Nylon Hammocks

When G. I.'s first went into South Pacific jungles, they used a sleeping hammock with a regular mosquito netting canopy that hung to the ground. That way—it was thought—insects wouldn't be able to get into the hammocks. Unbelievable as it may seem, termites ate their way right up the netting and then across the hammock—so fast that they cut it like scissors, in one night! So now nylon netting is used. Not only will termites leave it alone, but it resists mold, dries quickly after tropical rains, is mildewproof and weighs less than cotton, although it has nearly twice its tensile strength.

Railroad Cars

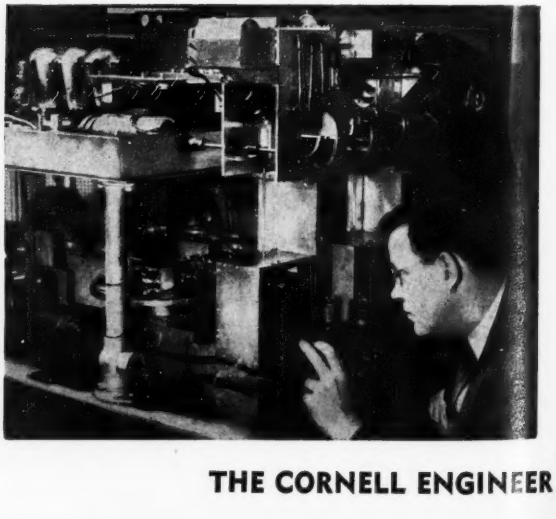
Railroad passenger cars of tomorrow will be so completely equipped electrically that a 20-kw power plant will be required to handle the load. In addition to air conditioning, car planners are considering electrically refrigerated water coolers, electrostatic air cleaners, and

A model of the P-61 Black Widow, and behind it the remote controlled top turret housing four .50 caliber machine guns.

—Courtesy General Electric

A General Electric engineer is shown with the amazingly intricate machine that is used to test samples of turbine nozzles. This machine automatically prints the data of tests which become the bases of improved turbine design.

—Courtesy General Electric



greatly increased lighting, probably with fluorescent lamps. An entirely new 76-volt, axle-driven generator has been developed to supply the necessary power for a 64-volt car power system which replaces the old 32-volt system. Light weight and small size are achieved in part by high speed. Built into the generator frame is an alternating-current motor to drive the generator when the train is standing in terminals and to permit testing of the system without moving the car.

To provide alternating current for fluorescent car lighting, a new lightweight motor-generator set (rated at 4-kw at 3600 rpm) has been developed. By a new arrangement of fields on the motor and the generator it is possible to hold the frequency between 58 and 62 cycles, and the voltage between 110 and 125 volts for the great variation in load and battery voltage that can be expected.

Screens

ULTRAVIOLET screens of dark purple glass are used by the Signal Corps to transform searchlight beams into invisible light. Used in connection with cloud height finding devices, these screens filter out all visible light from the tiny but powerful match-shaped mercury lamp, which operates at so high a temperature that it must be constantly aircooled. The screen sometimes reaches temperatures far exceeding that of boiling water, and is therefore built in small panes to localize shock caused by exterior temperature changes.

New Conductor

THERE is always a danger of an explosion in hospital operating rooms due to static electricity touching off a mixture of ether and air. To guard against this, Du Pont has developed for the Navy a special type of neoprene synthetic rubber-coated hospital shelving which is a conductor capable of carrying off static electric charges.

Camera Shutter

AN electronic control that automatically synchronizes a new type of shutter for aircraft cameras with the bursting of a flash bomb, thus enabling military observers to photograph from high altitudes and at night the destruction caused by their explosives, has been developed through the collaboration of the General Electric Company and the Folmer Graflex Corporation.

A photoelectric cell automatically opens the shutter at the peak of illumination of the flash bomb which occurs approximately 1/100 second after the flash burst. After the desired exposure time the control closes the shutter of its own accord. The camera automatically winds the film and it is ready for another picture. The whole procedure results in standardized exposure and saves the observer precious minutes.

The brains of this robot control is a sensitive photoelectric cell that acts on the light impulse coming from the bomb. When the flash explodes, the photoelectric cell picks up a light impulse, amplifies it and transforms it into a current to which the shutter responds in less than 1/500 of a second. Small enough to fit into a hat bag and weighing only nine pounds, this robot device was designed especially for use on reconnaissance planes and bombers. Both photoelectrical cell control and shutter are shockproof in construction. When in use, the control operates on three-billionths of a watt—about the equivalent of the energy spent when a human hair falls 1/10 of an inch.

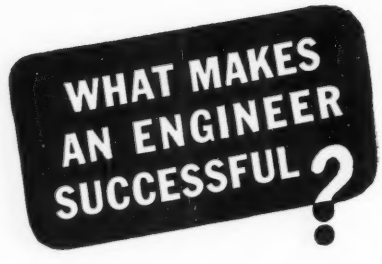
—Courtesy General Electric

Inspection of ball bearings for gyroscopes.

Jet Engine

THE beginning of the jet engine production on a volume schedule for the AAF combat operations was marked by the completion of the first jet engine at the General Electric Company's second largest war-

(*Continued on page* 30)



● How does an engineering student eventually become vice president or head of a company? What—over and above his technical education—must he know to qualify as a top executive?

The answer is: a basic understanding of practical business principles and methods.

It is this PLUS knowledge that enables him to see beyond the specialized activities of one department—to grasp the importance of Marketing, Finance and Accounting as well as Production.

Fundamentals Needed

The Alexander Hamilton Institute's Modern Business Course and Service provides a thorough groundwork in the fundamentals underlying *all* business and industry. With the help of this intensive training, an alert man can accomplish more in months than he could, ordinarily, in years!

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There is a scientific quality about the Institute's Course and Service that appeals to technically-trained men. That is why there are so many prominent members of the engineering profession among the more than 400,000 subscribers. They include: J. W. Assel, Chief Engineer, Timken Steel & Tube Co.; Lewis Bates, Plant Mgr., E. I. du Pont de Nemours & Co.; Lewis P. Kalb, Vice President, Chg. Eng. & Mfg., Continental Motors Corporation; H. W. Steinkraus, President, Bridgeport Brass Co.

Institute training fills the gap in ordinary technical education, and provides access to the thinking and experience of many famed industrialists. It is basic, broad in scope and fits into a busy schedule.

Prominent Contributors

Among the prominent men who have contributed to the Course and Service are: Thomas J. Watson, President, International Business Machines Corp.; Frederick W. Pickard, Vice President and Director, E. I. du Pont de Nemours & Co.; Clifton Slusser, Vice President, Goodyear Tire & Rubber Co.

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Wage Trends

(*Continued from page* 9)

these processes by two examples:

I have obtained the cost history for the past 30 years of a 5 H.P. AC industrial motor. In 1910 this motor was manufactured in a factory where the average earned rate was 26.5 cents per hour; the standard work week was 54 hours. In 1940—thirty years later—the wage rate was 80 cents an hour, just three times the 1910 rate; the standard work-week was 40 hours, and the direct labor cost (rate times hours) had been reduced to 85% of the 1910 labor cost, in spite of a wage scale three times as large.

An Example

The reduction in man-hours of labor in the assembly of the ordinary household incandescent lamp is still more striking. This work is done largely on automatic machines by relatively unskilled women. In 1924 the average hourly rate for this class of labor was 37 cents; it had increased to 57.8 cents per hour in 1940 or to 156% of the 1924 rate. The direct labor cost per lamp in 1940 was only 19% of the corresponding cost 16 years earlier, and hours per lamp had been reduced to 12% of the hours required in 1924. In this case wage rates were increased, and selling prices were reduced. The 100-watt lamp sold for 60 cents in 1924, and a better lamp of the same size sold for 15 cents in 1940.

Universal experience points to the truth of this fundamental importance of efficiency and low labor cost. The most efficient company, with the lowest labor costs, usually pays the highest wage rates; the efficient, mechanized, capital-consuming industry pays a higher wage scale than hand-labor industry can afford; and the United States, with the highest productivity and capital investment in the world, paid 1½ times the wage scale of Great Britain, and produced twice as much per worker, back in 1929.

We can now apply these principles to the specific question of wartime versus peace-time wage rates. We have found that high wage rates can be supported only by still higher industrial efficiency.

The question that requires an answer in our present situation is whether the increases in wage rates, that have occurred over the past ten years, and particularly over the past three or four years, have been matched by the necessary increases in efficiency and productivity.

This is not an easy fact to establish; measurement of national productivity is difficult as a statistical problem, and the results are far from satisfactory. Two contrary answers have been given recently by two highly respected and competent authorities. The Department of Commerce has taken the position that productivity has continued to increase at the old peace-time rate of 2½% to 3% a year during the war and will continue to increase during the transition period. The Brookings Institution, on the contrary, believes, less optimistically, that efficiency has not increased at all since 1940 and will not begin to increase again until after the transition to civilian production has been completed. These different conclusions can result in a 20% difference in the forecasts of total national production in a post-war year such as 1947; and account for the difference between the Department of Commerce estimate of 140 billion net national income in 1947, and 127 billions, estimated by the Brookings Institution.

Based on my own experience and observations in war production, I do not believe there has been worth while net increase in national efficiency during the war that will become effective in peace-time production before the reconversion period has been completed.

A Balance

It is true that new materials, new equipment, and new processes have been developed in war production, but all these new things require opportunity and time to apply in the manufacture of radically different civilian products and to make themselves felt in natural production.

We can make a rough comparison between the increase in wage rates and the increase in productivity if we start from some year during which a satisfactory workable balance existed among these factors of market prices, wage rates, and productivity. We know that for a long term of years prior to

(*Continued on page* 28)

Retrospect

(*Continued from page* 11)

the "organization" want this project which gives the engineer his basic job? That's easy. It's our primary "profit" motive and the organization has determined that there is a market for the project's function. Well, what creates "markets"? These do indeed spring from the fundamental human desire for better living, and this is the least common denominator of our constant striving to do "more" in a "better way." Such reasoning has brought us through some rather unfamiliar fields. The terms "organization," "profit," "market," "human desire" and "better living" savor of "liberal arts" and heaven forbid an engineer being caught dead with any such taint of association. (Things are coming to a pretty pass. Someone will be suggesting that "Appreciation of Greek Literature IV" become a required engineering course, or possibly "Marriage Relations, III"). Is it possible that our rugged individualism, our student day prejudices, our "love of the job," and some other criteria of engineering "religion," have caused us to miss the professional boat. Well, it's not as black as all that, but there has been a trend thereabouts. There is no particular need to stifle these inheritances. They have a distinct value in our growth, but they must constantly be properly equated.

Tough Climb

The climb has been tough for every recognized profession. The clergy had a most difficult problem up through the centuries to eliminate the insincere and the parasites, and marked improvement has only come in recent years. The present war has brought the clergy through its greatest evolution. Only now in the services of our armed forces, encouraging inroads have been made upon the blights of dogma and denominationalism. Surgery has had a tough uphill fight from the butcher of the Middle Ages. It has been a long bitter human experience from the cleaver to the scalpel. The same is true for law. Centuries of effort are evidenced from Phariseeian writ to modern jurisprudence. All professions have found it necessary to maintain unrelenting vigilance over their citadels of practice, for unless they set up constantly higher-than-garden-variety standards, with the difficulty of the paths of approach varying directly, they slump via overwatered ratio to worthless strength.

The three major columns which have been found over the ages to properly sustain professionalism are education, licensing, and highly ethical practice. By forthright approach, engineering in all of its branches, will construct in years what it has taken other professions centuries to accomplish. The life blood of our "go" and "can do" is our versatile ability to overcome encountered conditions, and we are in the process of titrating this professional admixture right down to the third decimal.

Pedagogy

Pedagogy is of ancient origin, and it has gained over the centuries a relative higher order of professionalism — certain student opinions notwithstanding. Engineering pedagogues have earnestly striven to uphold proper standards in at least the formal educational requirements of the profession. Engineering educators are familiar with the Wickenden Report wherein, only fifteen years ago, the first thorough analysis of engineering curricula was made. Only those engineering schools that meet definite requirements are now "accredited" by the Founder societies.

Five-Year Plan

Our College of Engineering is taking the next step by shifting to a five-year plan for its regular postwar curricula. Thereby the older schools of Cornell will follow in the steps so deftly taken by the younger Chem. E's some years back. The Dean, Directors, and faculties are establishing the policy of utilizing at least half of the additional curricula, made available in a five-year plan, for more liberal subject matter. Such courses as "Modern World History", "American Government", "Economics", "Money, Currency and Banking", and "Social and Labor Relations" are definitely in the cards. Other universities are, now, very much interested in the Cornell Plan. The remaining part, and possibly the more important, is the individual's continued education associated with living, and practice. Yes, graduation completes the educational game just like summing up the love affair with the wedding and ending the story with "—and they lived happily ever after." The educational pillar thus has a bright outlook.

The past quarter century has witnessed the rigid licensing of engineers in all states. Laws enforc-

(*Continued on page* 40)

Surveying party 1900 or thereabouts, Cornell Summer Surveying Camp.

William Littlewood

(*Continued from page* 21)

volving triumphs and failures due to some basic engineering problems, which were almost unsolvable at the time, and a vast amount of work and disappointment, the cam engine development was cancelled. Littlewood was then appointed General Manager of the Fairchild Engine Company which continued with subcontract aircraft engine manufacturing obtained from P&W, Wright Aeronautical, Bliss and other companies. In 1928 he was sent abroad to negotiate an aircraft engine

Mr. Littlewood is shown making one of his frequent inspection tours with officials from American Airlines and Douglas Aircraft Company. The above plane is a C-54 transport.

manufacturing license with the Armstrong Siddley Company of Coventry, England. Littlewood brought back a detailed account of the design, material, tooling and manufacturing processes used in the manufacture of the engines under license and proceeded to adapt them to American processes and equipment.

Shortly thereafter Littlewood on behalf of Mr. S. M. Fairchild negotiated with Mr. Walter F. Davis, then of the Wright Aeronautical Corporation, an agreement by which Mr. Davis and his designs of an inverted inline air cooled engine became the development project of the Fairchild Engine Company. Once the engine development program was under way with no prospects of engine manufacture in the near future, Littlewood, at the request of Mr. F. G. Coburn, President of the Aviation Corporation, made an engineering survey of American Airways, the operating subsidiary, to study the needs of air transportation with respect to aircraft equipment designs. Following the preparation of this report he was definitely transferred to the air transportation activity of the Aviation Corporation and assigned to special engineering projects, including a comprehensive survey of aviation fire prevention and protection. Previous to the initiation of this study American Airways losses by fire both in aircraft equipment and buildings had been startling, consummating in a Chicago hangar fire which destroyed a large number of airplanes and valuable equipment. The results were an almost total elimination of fires for a number of years thereafter. Through this approach Littlewood was placed in charge of maintenance engineering for American Airways and in 1932 moved with the re-organized company to St. Louis and thence to Chicago. After the re-organization he became Chief Engineer of the Company in charge of all its technical engineering activities. These involved the specification, testing and indoctrination of new aircraft equipment, including all the types employed. In January 1937 Littlewood was elected Vice President in charge of Engineering for the Company which in 1934 had been re-constituted as American Airlines, Inc.

In 1935 he was awarded the Wright Bros. Medal for outstanding contribution to aviation. Shortly thereafter he was elected a Fellow of the Institute of Aeronautical Sciences. A good share of the years 1935 and 1936 were spent by him in Santa Monica, California working with the Douglas Company in the detail development of the Douglas DC-3 airplane, and the corresponding DST sleeper version. This airplane in its Army cargo version, the C-47, has become the backbone of cargo air transport during the second world war. Littlewood has also had a large share, from the beginning, in the specifications of the Douglas DC-4 which, as the C-54, supplies much of the long range Army transport require of the second world war. A most recent development in that field has been the negotiation of DC-6 specifications, covering an advanced high speed transport for post-war use.

At the present time in addition to his American Airlines position, Littlewood serves as Vice President of the Society of Automo-

(*Continued on page* 34)

TRACKING DOWN TROUBLE

This laboratory, ready to move anywhere on short notice, runs down "crimes" against good telephone service. Finding these threats is one of the many jobs of the Bell Telephone Laboratories' scientists. The "criminals" are such things as threads of lint, traces of acids, or sulphur compounds in the air—any of which might damage telephone equipment.

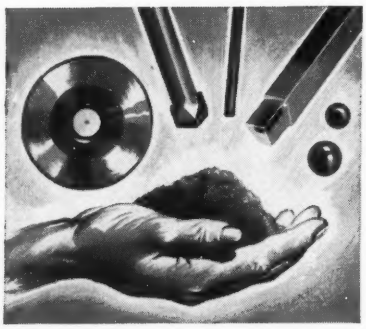
In their interesting war work, Bell Laboratories' scientists have been on a new kind of hunt. They have tracked down different materials for those hard to get, found others that would serve in special conditions, and have detected in captured equipment the kinds of material the enemy uses.

These are some examples among many of the ways Bell System research is helping to serve America at war.

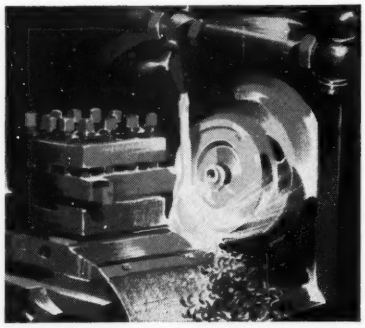
BELL TELEPHONE SYSTEM

"Service to the Nation in Peace and War"

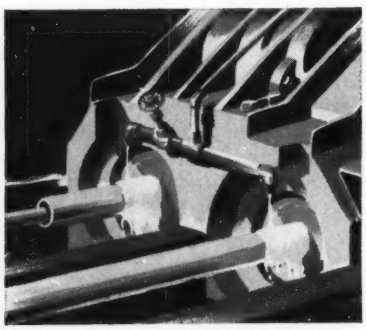
What does "the hardest metal made by man" mean to you?



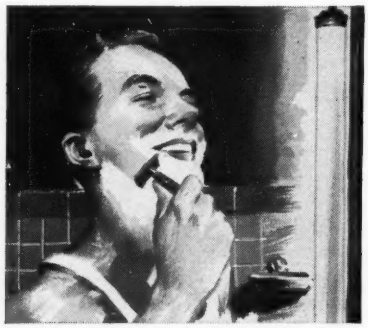
1 IT STARTS AS A MIXTURE of simple metallic powders. Under heat and pressure, it becomes the hardest metal made by man . . . Carboloy Cemented Carbide. Its uses are endless. In tools, dies and wear-proofed parts, it is performing wartime miracles of *high production* at *low cost.*



2 AS A TOOL! Official records show "production of crankcases and gears for aircraft engines was tripled, *with the same equipment and manpower,* by the use of carbide tools." And no wonder! For they work at speeds and to close tolerances formerly impossible in mass production.



3 AS A DIE! "In making tubing for tanks," says the chief engineer of a great tubing plant, "Carboloy drawing dies have produced an almost unbelievable number of times the footage of any other type." In sheet metal forming also, this miracle metal is pointing the way to unprecedented savings in production costs.



4 AS A WEAR RESISTANT METAL! The use of Carboloy plates to insure uniform hardening made possible the successful manufacture of the extra thin razor blades so many men prefer. Carboloy inserts step up the life of inspection gages, valves and machine parts such as cams and bushings as much as 100 times.

An industrial weapon for war and peace

BIGGER output through high-speed operation! Better products through high precision! Lower cost through man and machine hours saved!

That's the story of Carboloy Cemented Carbide — whether for speeding up present war production, or for a competitive edge in the postwar "battle of costs."

And remember—the history of Carboloy has been one of steady price reduction. We believe this price story will interest you.

CARBOLOY COMPANY, INC., DETROIT 32, MICHIGAN

CARBOLOY
TRADE MARK
CEMENTED CARBIDE

The Hardest Metal Made by Man

Wage Trends

(*Continued from page* 24)

1930, national productivity increased at an average rate of 2½% to 3% a year, compounded annually.

We will have to go back to 1929 for a starting point. This is the most recent year for which we can reasonably assume a balanced situation, resulting in a satisfactory level of employment. Remember also that the increase in efficiency should be larger than the increase in wage rates, because a higher wage scale is only one of the ways in which the benefits of increased productivity are distributed. The others are lower market prices of manufactured goods and shorter hours. These results are only approximate because some allowance should be made for changes in the average price level of raw materials, which I have not done.

The average hourly earnings in manufacturing increased from 59 cents in 1929 to $1.01 in 1943, or 70%.

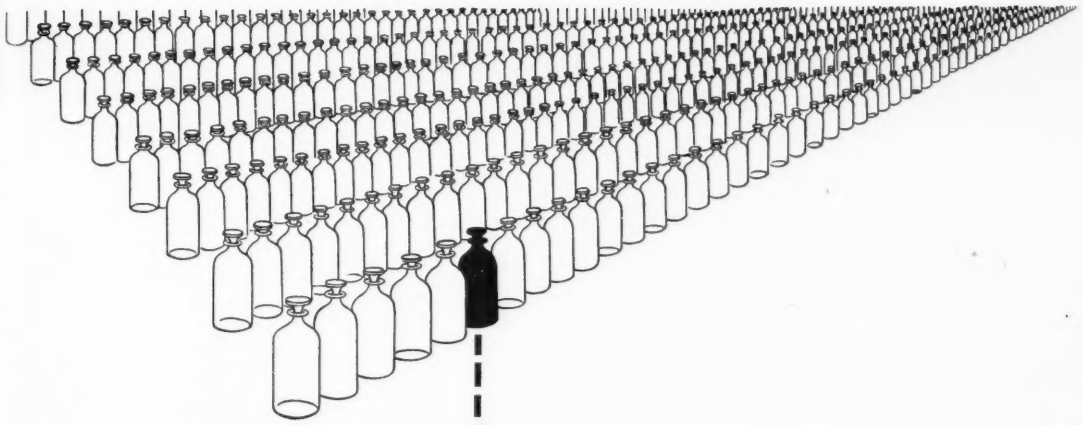
Efficiencies

The assumed increase in efficiency for these 14 years would amount to 51% (3% compounded annually). Consequently, the increase in wage payments alone, used up more than the total increase in efficiency by 37%.

If we assume pessimistically that there was no increase in national efficiency after 1940, on account of the change to war production, the total increase in efficiency would be 38%; and, under these assumptions, wage payments increased 184% of the gain in efficiency. It is probable, therefore, that the considerable wage increases since 1929 outstripped any likely increase in production efficiency, by a considerable margin. Most of the divergence has occurred since 1940.

My own opinion, as I imagine you have guessed by this time, is that many existing wage scales are considerably out of balance on the high side; and, if this situation continues, and still worse, if the unbalance is increased by additional wage-rate increases in the immediate future, serious mass unemployment may develop as industry goes through the reconversion process If

(*Continued on page* 32)

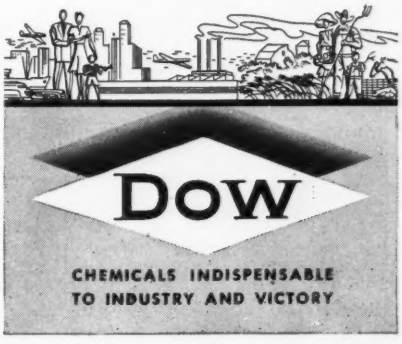


Industry's "special account" with Dow

It is characteristic of large scale chemical operations, such as Dow's, that one thing leads to another. Sometimes materials emerge from development work not specifically sought for in the original task. Yet they are the logical result of established chemical reactions. Their properties, of course, are known, but their ultimate usefulness to industry has not been completely charted.

There are probably as many as 7,000 of these chemicals and chemical compounds that have emerged from Dow laboratory developments. They are neither accidents nor by-products, but co-products. They align themselves readily into scientific groups—for example, phenolic derivatives. From time to time these are referred to technicians in various manufacturing fields who may find among them *just the needed chemical ingredient* to put the finishing touch to their own work in progress.

To borrow a banking analogy, these chemicals are industry's "special account" with Dow on which it can draw so that constructive developments may proceed to their successful conclusion. And thus America at large has a genuine stake in this accumulation of potential assets.



THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago
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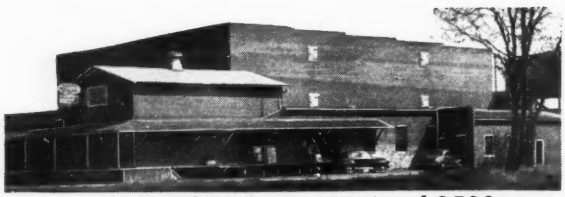


How this plant serves a town of 2500 as the Community Refrigeration Center

Ice Delivery

Fruit Storage

Refrig. Food Lockers

Meat Chilling

An ice plant of only 10 tons capacity a few years ago, the Greencastle (Pa.) Ice and Cold Storage now handles up to 80 tons daily, sells ice refrigerators, supplies farmers with ice for cooling milk, chills 600 tons of cherries in ice water before pitting, ices many refrigerator cars. ● It stores 100,000 bushels of apples, and freezes big hogsheads of peaches and berries, all from its own packing house. ● Meats, poultry, vegetables, and cream are frozen and stored. Twelve hundred refrigerated lockers are rented. Fresh-killed calves and sheep (4000 per month) are chilled before being shipped. ● The ice cream bar sells lunches; a cold room serves as a milk substation; beer was formerly handled at wholesale. Quick-freezing of locally grown foods in great quantity is the next step. ● We believe every progressive town can profit, in the postwar world, from a COMMUNITY REFRIGERATION CENTER. You are welcome to make use of the consulting-engineering service and equipment we offer for this program.

FRICK CO., Waynesboro, Pa.

Manufacturer's Agents Wanted

in each of the following cities in New York State: Albion, Attica, Auburn, Batavia, Carthage, Corning, Dansville, Depew, Elmira, Geneva, Ithaca, Olean, Oneida, Oswega, Rochester, Rome, Schenectady, Tarrytown, Troy, Utica, Warwick, Watkins Glen, Wellsville. Must be civil engineer, or draftsman able to correctly estimate quantities from blue prints, to promote its use and specification among architects and general contractors and sell cement tile on a commission basis.

●

Morse Cement Tile Company
North East, Penna.

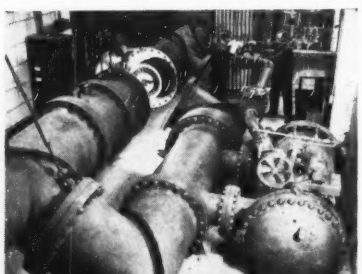
Techni-Briefs

(*Continued from page* 23)

time plant at Syracuse, N. Y. The superpowerful engine is capable of driving planes at lightning speed, at altitudes more than six miles above the earth.

The jet engine was first developed in the United States for the AAF by General Electric engineers, who made the first engine in the short period of six months, working from a British design.

The first jet was developed in Lynn, Massachusetts, in 1941-42.



Highpressure wind-tunnel and model for testing Westinghouse blades.

The Bell P-59-A aerocomet was the first propellerless jet propelled plane in this country in October, 1942. Since then, numerous experiments have been performed on the engines, and the results incorporated in the present engines.

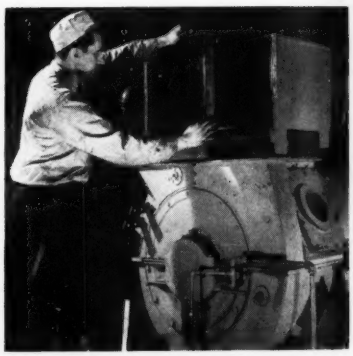
Results of tests proved that the engines were needed in volume. Contracts for mass production went to General Electric Company which immediately converted the Syracuse plant where turbine-electric power units for destroyer escorts had been produced. The plant covers more than 600,000 square feet of floor space. The Allison Division of General Motors also will produce jet engines.

Wind Tunnel

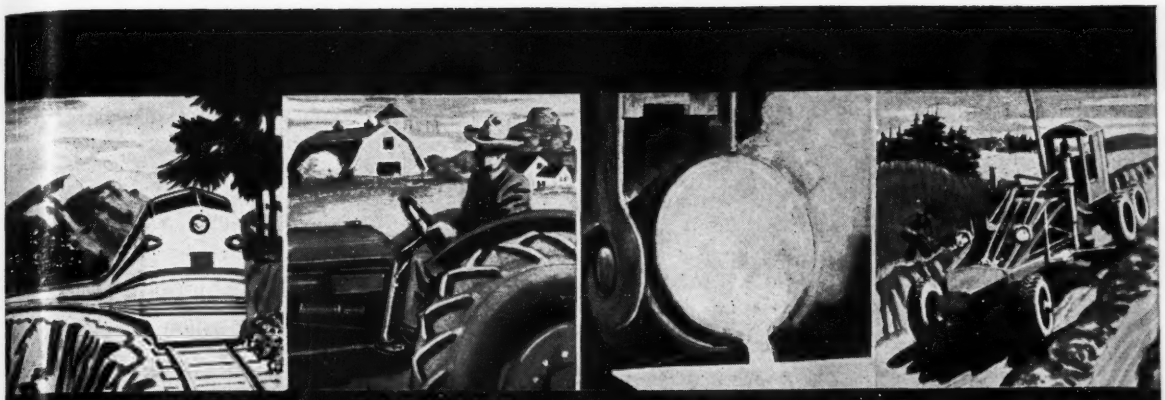
WITH the aid of a new type pressure wind tunnel, tests on turbine blades may be made many times faster than with the conventional wind tunnel.

The wind tunnel previously used provides information on the aerodynamics of blades under high gas velocities and gives the exact, accurate data needed for final designs. The models, however, must be carefully made of steel to withstand the high velocity. The wind tunnel iteself is massive, and requires a great deal of power to drive it. As a result seldom can a half dozen tests be made in a year with it. Because the new tunnel, on the other hand, tries the blades at low speed at high pressure (220 lbs. instead of atmospheric) the models can be fashioned of wood.

(*Continued on page* 46)



The Westinghouse Precipitron will keep marine generator windings and insulated parts free from dirt, carbon dust, and oil vapor.



Universally used and endorsed by engineers everywhere

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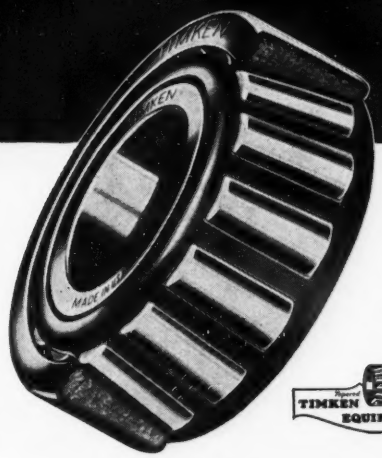

The leaders in practically all industrial fields, almost without exception, use Timken Bearings in the products they make — the machines they operate. Such acceptance is due to but one fact — Timken Bearings mean dependable performance. Low cost operation and maintenance are common denominators to all industry and that is why Timken Bearings solving these problems, are a basic and integral part of all industry. It is the reason why engineers, not only in America, but throughout the world, recognize the advantages inherent in Timken Bearings. To insure the utmost in anti-friction bearing performance — first have the application engineered by The Timken Roller Bearing Company and then use the Timken Bearing that our experience recommends.

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STEEL CORPORATION · HARRISBURG, PENNSYLVANIA

Wage Trends

(*Continued from page* 28)

this opinion is correct, we have been going through an inflation in wage rates since 1940, and we have experienced a serious halt in growth in efficiency on account of war dislocations; and unfortunately neither of these conditions can become apparent until the abnormal supports of war contracts and government credit are removed.

A high wage scale accompanied by mass unemployment does not help the unemployed; nor does it produce the maximum purchasing power. We have been doing too much talking about full employment and providing jobs, and too little thinking about the conditions necessary for full employment.

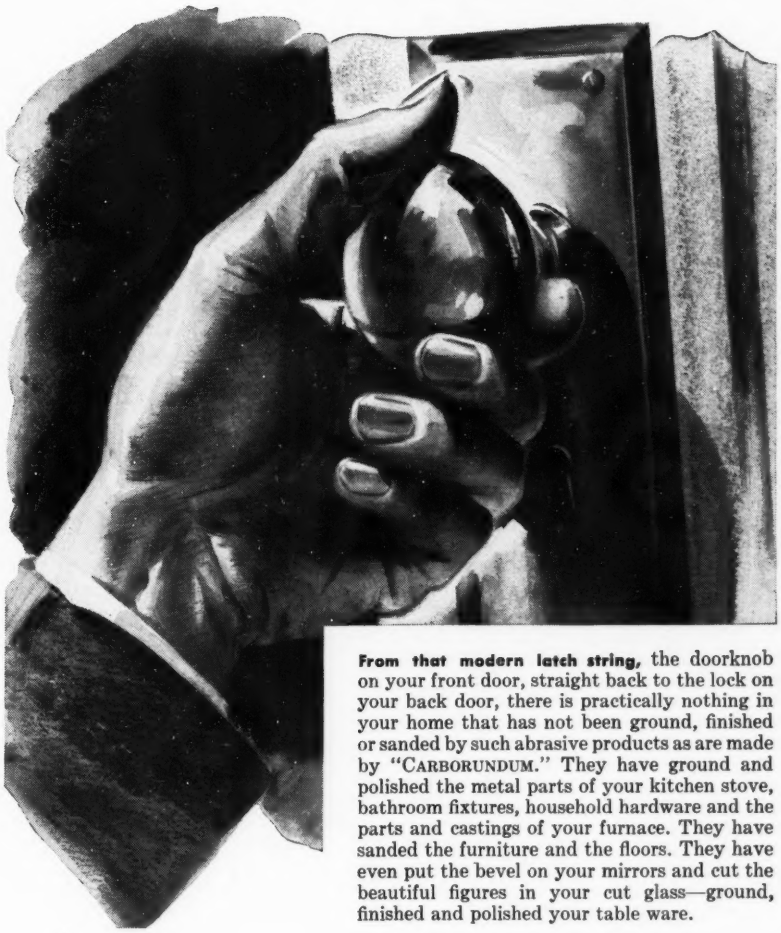
What then should be our wage and price policy from this point on?

No One Answer

I will not say whether wage scales or market prices should be raised or lowered. No person or government board is wise enough to answer questions of this kind. And no one answer can be right for the thousands of individual situations in industry. We should, however, take steps, and the sooner the better, to permit the normal adjustments in industry to reestablish new balance points for wage scales, labor costs, and market prices in all of these individual situations.

Wage scales and market prices should be allowed to find the levels that will produce maximum employment and maximum national income through the bargaining processes of private industry. Neither labor nor management should be afraid to go back to these familiar processes, and throw away the crutches of government controls, as soon as our doctors will permit. All of the grand and impressive predictions of post-war employment and national income, currently publicized, may have no more weight than a film of cobweb floating in the air, unless a realistic wage and price policy, under which private industry can provide satisfactory levels of employment, is adopted and put into effect very soon. We need economic answers to these economic questions, just as quickly as orderly reconversion will permit.

How to put a polish on a Latch String!



From that modern latch string, the doorknob on your front door, straight back to the lock on your back door, there is practically nothing in your home that has not been ground, finished or sanded by such abrasive products as are made by "CARBORUNDUM." They have ground and polished the metal parts of your kitchen stove, bathroom fixtures, household hardware and the parts and castings of your furnace. They have sanded the furniture and the floors. They have even put the bevel on your mirrors and cut the beautiful figures in your cut glass—ground, finished and polished your table ware.

The truth is there is practically no industry which does not, somewhere employ abrasives, super refractories or "GLOBAR" electric heating elements by "CARBORUNDUM." Applying "CARBORUNDUM" engineering knowledge to various industrial problems can be a fascinating career. If you are interested, please write The Carborundum Company, Niagara Falls, N. Y.

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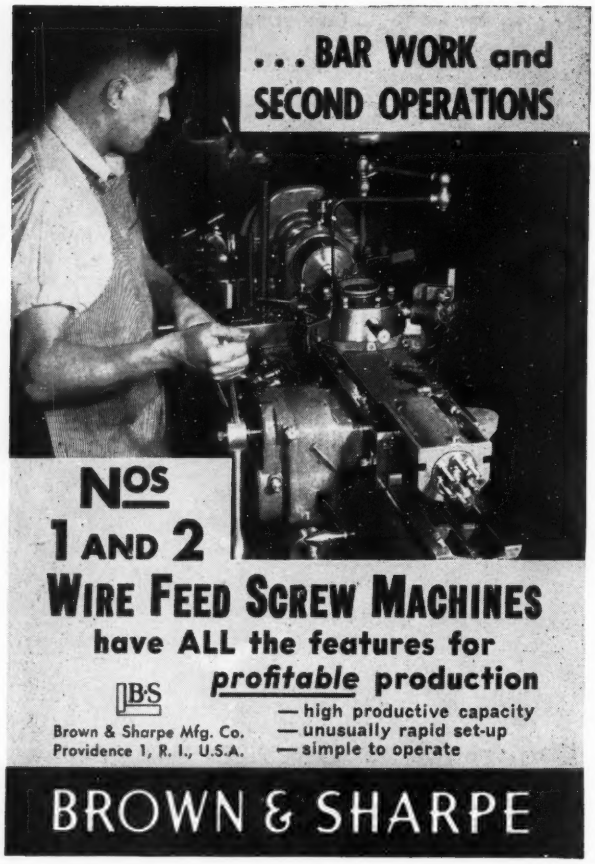

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This company is experienced in railroad, airport, utility, highway and industrial construction.

INQUIRIES ARE INVITED

William Littlewood

(*Continued from page 26*)

tive Engineers as head of the newly formed Air Transport Engineering Activity. He is a member, by Presidential appointment, of the National Advisory Committee for Aeronautics, and is Chairman of the Committee on Power Plants for Aircraft, serving under the main NACA Committee. He is also a member of the Executive Committee of the Coordinating Research Council, Chairman of the Aircraft Requirements Committee for the Air Transport Association of America, Chairman of the Accessories and Equipment Subdivision of the SAE Aeronautics Division in the field of standardization, and serves on numerous Committees associated with the engineering educational institutions and technical activities. He also serves as a member of the Executive Council of the Cornell Society of Engineers.

As diversion from the day to day business responsibilities, Littlewood, Sr. occasionally functions as a cellist, likes to build things in his basement shop, and is greatly interested in boating, fishing, and farming. Cornell ties are maintained through innumerable friends and business associates, and at the Cornell Club of New York.

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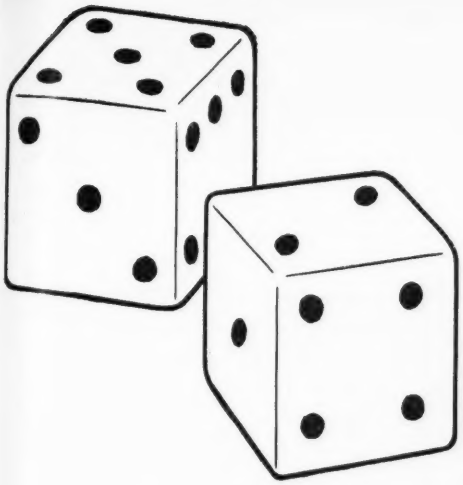
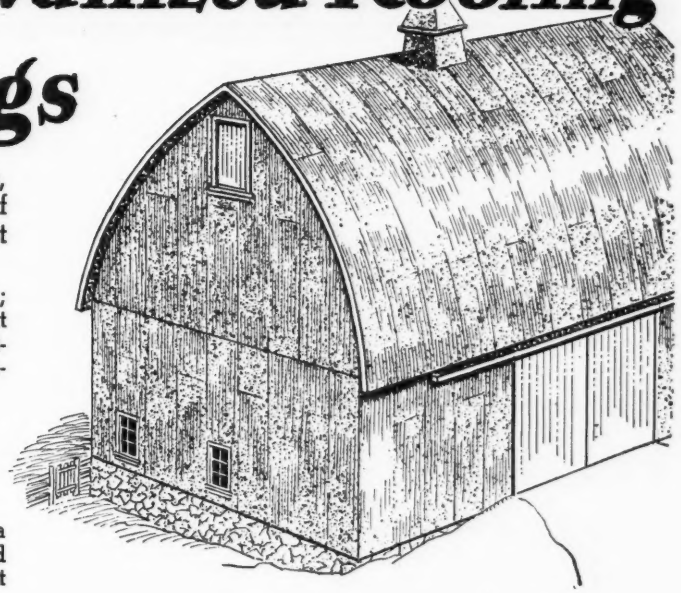


It's GOOD LUCK *to have Galvanized Roofing on Buildings*



For in these days of material scarcities, galvanized roofing can be taken care of by simple, easy means and made to last a lifetime.

Galvanized roofing is zinc-coated roofing; and the U. S. Bureau of Standards states that zinc is "by far the best" protective metallic coating for iron or steel! Zinc in the form of galvanizing provides double protection:

First, by simple coverage, with a sheath of rust-resistant metal.

Second, by electro-chemical action or "sacrificial corrosion."

Galvanized roofing is used on more than a third of all the farm buildings in the United States — which proves that farmers are smart judges of roofing value!

Take Care Of It!

It's just good business to take good care of galvanized roofing. It is so easy to do it, too, that there's no excuse for neglect. With reasonable care, galvanized roofing can be made to give a lifetime of satisfactory service. Get a copy of the free booklet

"How to Make Galvanized Roofing Last Longer"

and the few simple steps to take will be made completely clear. The booklet is valuable. It's free—write for it today.

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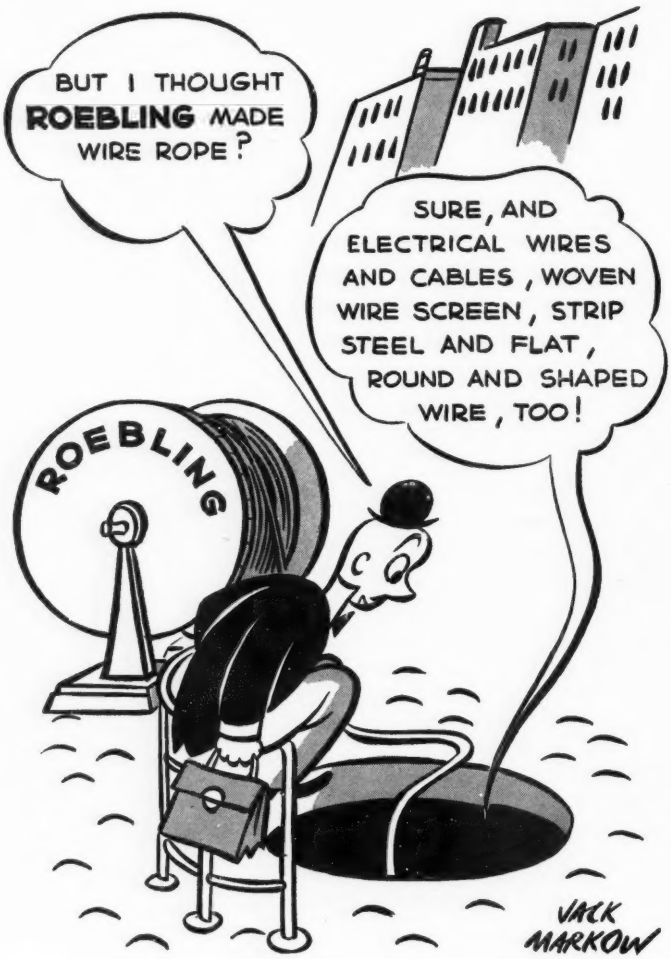
Ad No. 2—A.Z.I.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Helicopters

(*Continued from page* 13)

says, "It may be possible eventually to produce a two-place helicopter of 150 hp. for about five thousand dollars—*if they get into substantial production.* A four-place job when, in the distant future, it is perfected, will probably cost more than $10,000."

Quite recently, jet-propulsion has entered the helicopter field; and, as a result, it appears that many of the above disadvantages may be overcome. Fundamental feature of

Bell Helicopter

many jet designs is that they avoid torque on the rotor shaft, eliminating the necessity of a torque-reaction tail device and allowing use of a single main rotor.

One of the earliest advocates of the reaction-type, jet-propelled helicopter was the late Professor Montgomery Knight of the Georgia Institute of Technology. His staff have continued his work and developed a design in which the engine drives a blower which pushes air up through the shaft and out to the tip of a one-blade rotor. The air jet drives the rotor around and provides the helicopter with lift. Professor E. A. Stalker of Detroit proposes a similar design; but instead of exhausting air at the tip of the blades, he proposes to exhaust the air along the blade, thereby providing increased lift due to the controlled air flow on the boundary layer.

Jet Planes

Two other helicopters involve the use of pure jet propulsion rather than blowers. One of these planes has a conventional jet engine in the fuselage, piping the jet exhaust up through the shaft and out through the blade to nozzles at the rotor tips. The other idea is to install a small jet engine on the tip of each blade and merely feed gas

(*Continued on page* 38)

How Television Got Its Electronic "Eyes"

As revolutionary as airplanes without propellers—that's how much electronic television differs from the earlier mechanical television!

Whirling discs and motors required for mechanical television were not desirable for home receivers. Pictures blurred and flickered.

But now, thanks to RCA research, you will enjoy all-electronic television, free from mechanical restrictions—"movie-clear" television with the same simplicity of operation as your radio receiver.

Such "let's make it better" research goes into everything produced by RCA.

At RCA Laboratories, world-famous scientists and engineers are constantly seeking new and better ways of harnessing the unbelievable forces of nature . . . for mankind's greater benefit.

Electronic television is but one example of the great forward strides made possible by RCA research—opening the way for who knows what new miracles?

When you buy an RCA radio or phonograph or television set or any RCA product, you get a great satisfaction . . . enjoy a unique pride of ownership in knowing that you possess the finest instrument of its kind that science has yet achieved.

Dr. V. K. Zworykin, Associate Research Director and E. W. Engstrom, Director of Research at RCA Laboratories, examining the Iconoscope or television "eye"—developed in RCA Laboratories for the all-electronic television system you'll enjoy tomorrow.

RADIO CORPORATION of AMERICA

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RCA

Okonite's general catalog on wires and cables contains information on conductors and coverings, materials and fabrications, and a selector chart. Engineering students may obtain a free copy of this booklet by writing for Bulletin OK-1011. The Okonite Company, Passaic, New Jersey.

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Helicopters

(*Continued from page* 36)

and compressed air to the engines from the main fuselage.

Many startling predictions were made for helicopters when they were first introduced. Then the designers and manufacturers of helicopters powered by internal combustion engines began to issue statements that the helicopter was not yet fully developed and also would be rather expensive for private use. However, jet helicopters may soon swing these opinions back to a more optimistic view. An advertisement on page 132 of the April '45 issue of *Flying* introduces a startling new "Low Price Helicopter for Post-War Production." This jet propelled, two-place helicopter will sell for about $1500. The low price is made possible by a new-principle, light-weight, jet-propulsion motor and by mass production methods which employ the use of molded fuselages composed of specially integrated metal and surface plastics. The maker claims to have the exclusive manufacturing rights to the motor, the materials, and the method of mass production. Transportation cost will be one-half cent per passenger mile. Cruising speed will be 125-150 mph; top speed will be 200 mph; cruising range will be 1000 miles. Other claims include easy maneuverability and complete safety.

Such a ship would largely avoid

(*Continued on page* 40)

Sikorsky YR-5, used extensively for military purposes, seats two in tandem. The entire forward section is enclosed in plexiglass.

ALL CLEOPATRA NEEDED WAS A PORTABLE SEWING MACHINE...

CLEO was a hep-cat! She gave from the hip . . . but solid. Remember the time she met Julius Caesar rolled up in a Persian rug . . . and little else? All Cleopatra needed was a portable sewing machine to be voted one of the "ten best dressed women of the Nile!"

All the nuts, bolts and screws—all the shuttles, cams and needles—yes, even all the aluminum in a portable sewing machine were on earth then, but Cleo's cleverest Afrits and Genii lacked the "know-how" to Imagineer them.

We coined "Imagineering"* to describe how Alcoa, and other great groups of technicians, go about the job of supplying the methods, materials and machines of modern life.

Today . . . youth laments that there are no new lands to discover, no new frontiers to cross. And yet, in the uncharted kingdom of the mind, hardy pioneers are daily spanning new horizons in the twin fields of invention and adaptation. Aluminum offers exciting new opportunities to every intrepid Imagineer . . . who seeks new industrial worlds to conquer.

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*Imagineering equals the union of imagination, man's oldest mental development, and engineering his newest. Together they are the key to progress.

ALCOA FIRST IN ALUMINUM

ALCOA ALUMINUM

Helicopters

(*Continued from page* 38)

vibration, noise, control difficulties, slow forward speed, slow clutch disengagement at power failure, and excessive cost. If it can really be produced as stated, such a plane will undoubtedly sell in great numbers.

American designers have done to the helicopter in five or ten years what it took twenty or thirty years to do for the airplane. Five years ago the first successful flyable helicopter was tested. Today, we have a fleet of nearly 100 different designs, with several manufacturers waiting only for peace to arrive before going into production. Despite cautious statements, despite obstacles still present, the days of widespread private and commercial helicopter use are only a few years away.

Retrospect

(*Continued from page* 25)

ing this procedure have been adequately tested. So, this pillar seems to be reasonably well in place.

Ethical practice is about as difficult to take-hold-of and analyze as personal character. There is a diversion of opinion on the subject, but in work-a-day procedure you will find it quite tangible. It requires constant inspection made by real sampling and testing.

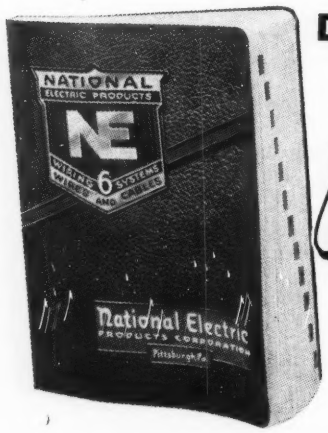
But what is the outlook for present war-time engineering students, and especially the V-12'ers? Their futures seem to be extremely uncertain. To a man (or a woman) they are curricular misfits. Everything is out of whack. They are "regimented". The courses they want aren't given, or their schedule won't allow for their inclusion. There is little time for extra curricular activities. The entire situation is hopeless—SNAFU to the Nth degree. Developing professionalism out of such a hodgepodge is impossible.

The Opposite

Actually, quite the opposite is true. Engineers utilize encountered opposing forces to aid in the accomplishment of our projects. Processed wastes are turned into valuable by-products. The military regimentation provides an excellent proving ground in learning to direct large groups of men. Also, by its extreme contrast to normal civilian life, it provides a social lesson that could never be obtained from textbooks. Regardless of how directly applicable, in your estimation, a subject may be, you will find that it contains a whale-of-a-lot of professional good. Why not utilize the getting along with "dumb" officers and "boring" faculty as real experience in management relations? You will find that your future employer has even greater idiosyncrosies. (Notwithstanding discernable groans, "It ain't possible!") Your ethical conduct in the classroom projects into enormous practice values. The earning of your livelihood may not be directly dependent upon these seemingly insignificant present relationships. When directed to do a job by the Great Horn Spoon let your first reaction be do it, and do it well! Don't mumble descension. Don't sneer your remarks to your fellows and threaten strike measures or writing to your congressman. If you consider the assigned task unreasonable, devise a professional man-to-man approach. Under such procedure you may often attain

(*Continued on page* 42)

Our 350 Page Electrical Engineering Data Book



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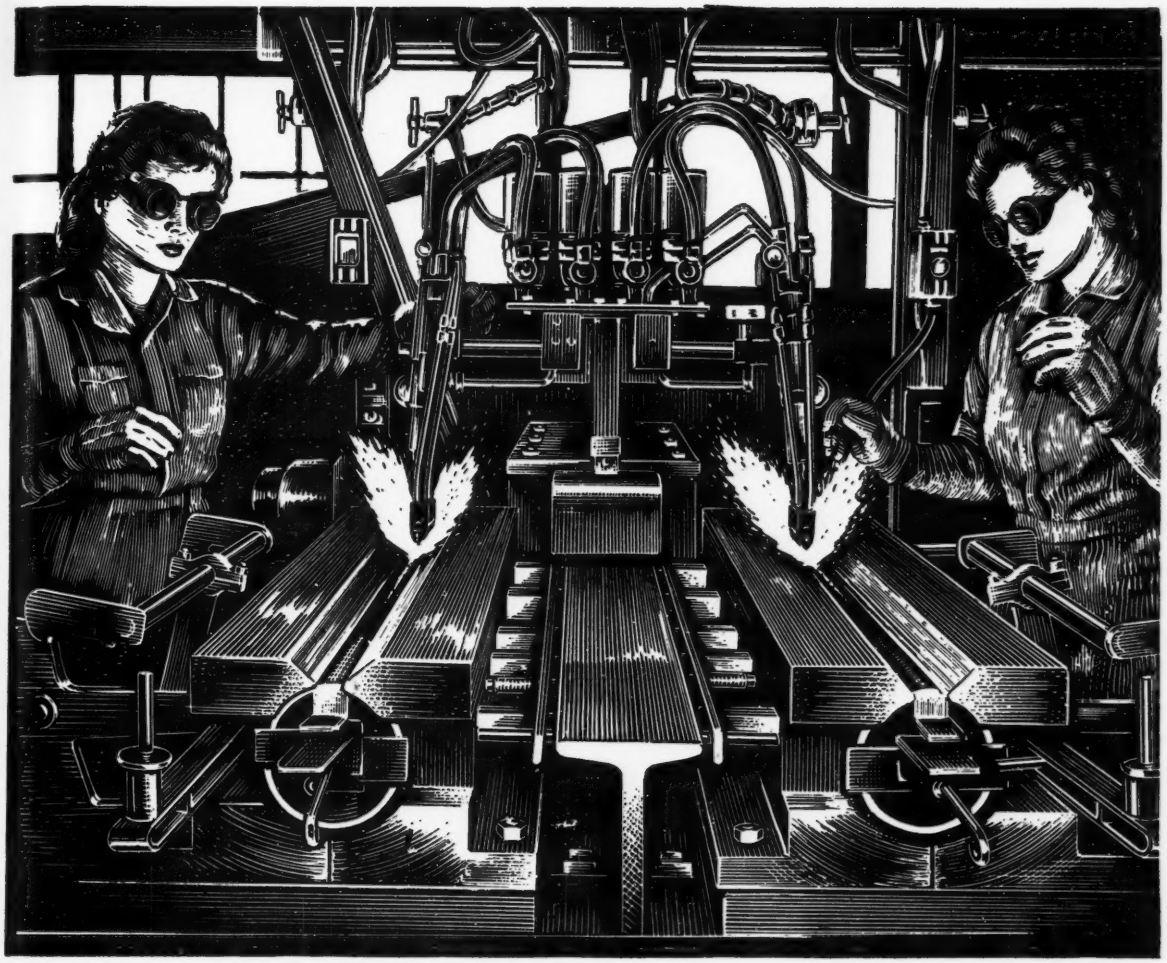

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SHELLS need protection against corrosion and other surface damage during their long journey to our global firing lines. Each shell is encased in a metal container—a "coverall" that preserves the lethal traveler on the long trip from arsenal to artillery post.

Automatic oxyacetylene flame welding machines perform the main tailoring operation in producing these metal shell-containers. Open seam tubes that have been formed from flat metal sheets are placed into each of ten identical welding machines, two of which are shown above. Then at the push of a button, all ten torches move as one, automatically stitching up the open seams. The operation takes only a minute . . . and the seams are tight and permanent.

This mechanical welding operation—developed in wartime by Airco Engineers—presents interesting opportunities for postwar manufacturing. It combines unusual speed with a high degree of weld uniformity, features that make for increased economy and reduced rejects

For additional information on Airco oxyacetylene flame and electric arc processes, write for a free copy of the interesting publication "Airco in the News". Address your request to Dept. CP, Air Reduction, 60 East 42nd Street, New York 17, N. Y.

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Retrospect

(*Continued from page* 40)

your immediate object, and you can't possibly lose in relationship experience gained.

Yes, it's the old stuff, reminissin' again, because all of this profundity is nothing more than any old-timer harkin'-back to his student days and wishin' he had 'em to live over again. Students don't change much, for where they go in for tobacco spittin' in one generation they shift to rabble rousin', in another. But these *are* different times. We must get things a lot faster or we'll be left to stew in our own gripin'.

You've probably heard that new song recently—it couldn't have been at Zinck's, or at the "Y" victrola dance for the U.S.O., parts of which would make an excellent engineers' song. It's got plenty of "go" and "can do". It has some rather potent idioms about "accentuatin' the positive"—and—"latchin' on to the affirmative" with "no messin' round with Mr. Inbetween", and there's another phrase very appropo "—or Mr. Pandamoneum will stalk upon the scene". It even has a nautical slant which involves Jonah's predicament in the whale. With a little interpolation this lyric could beat the Ramblin' Wreck, or The Stein Song, or Ca-sey Jones, all hollow.

Well, I gotta hurtle myself over into the bowels of Professor Schoder's piping emporium—the hydraulic lab, to you that haven't enjoyed the edifying experience of being exposed to NCE 6 as yet—and push the gang on past that window that overlooks the Tri Delt sun bathing shelf, to more technological demonstrations.

Alumni News

(*Continued from page* 19)

tioned.

Captain John G. Aldworth A.E., (E.E.) '42, U.S.M.C.R., *in the South Pacific has rejoined his outfit, having recovered from a wound received in an attempt to oust Jap snipers from a valley in Pelelui now referred to as "Death Valley." The Marines, on a ridge, had the valley flanked. Captain Aldworth thought that if he could get a machine gun to the edge of the ridge, the Marines could spray the valley. At dusk he gave the order and the gun was set up. But in the poor light the first bullet went over their heads and they hit the ground. Another smashed against the coral and ricocheted into Aldworth's left arm.*

Commander of a lightning squadron in the U. S. Ninth Army is Lieutenant Colonel Leon H. McCurdy M.E. '34, son of Professor John C. McCurdy '11, Agricultural Engineering. Col. McCurdy's squadron photographed, on daily flights, the landscape between the Roer and the Rhine Rivers. When platoon leaders lead their men across the Roer, each carried a photograph of the position to be captured and knew the exact location of enemy gun positions, fire trenches, and in some cases, mines. The squadron, which is part of a tactical reconnaissance group armed with only cameras, usually shoots enemy positions from 20,000 feet, but in bad weather sometimes as low as 2,000 feet. Mobile reproduction units constantly turn out prints. These prints keep the commanding officers informed on enemy movements and photo intelligence units use them to prepare detailed maps of the countryside.

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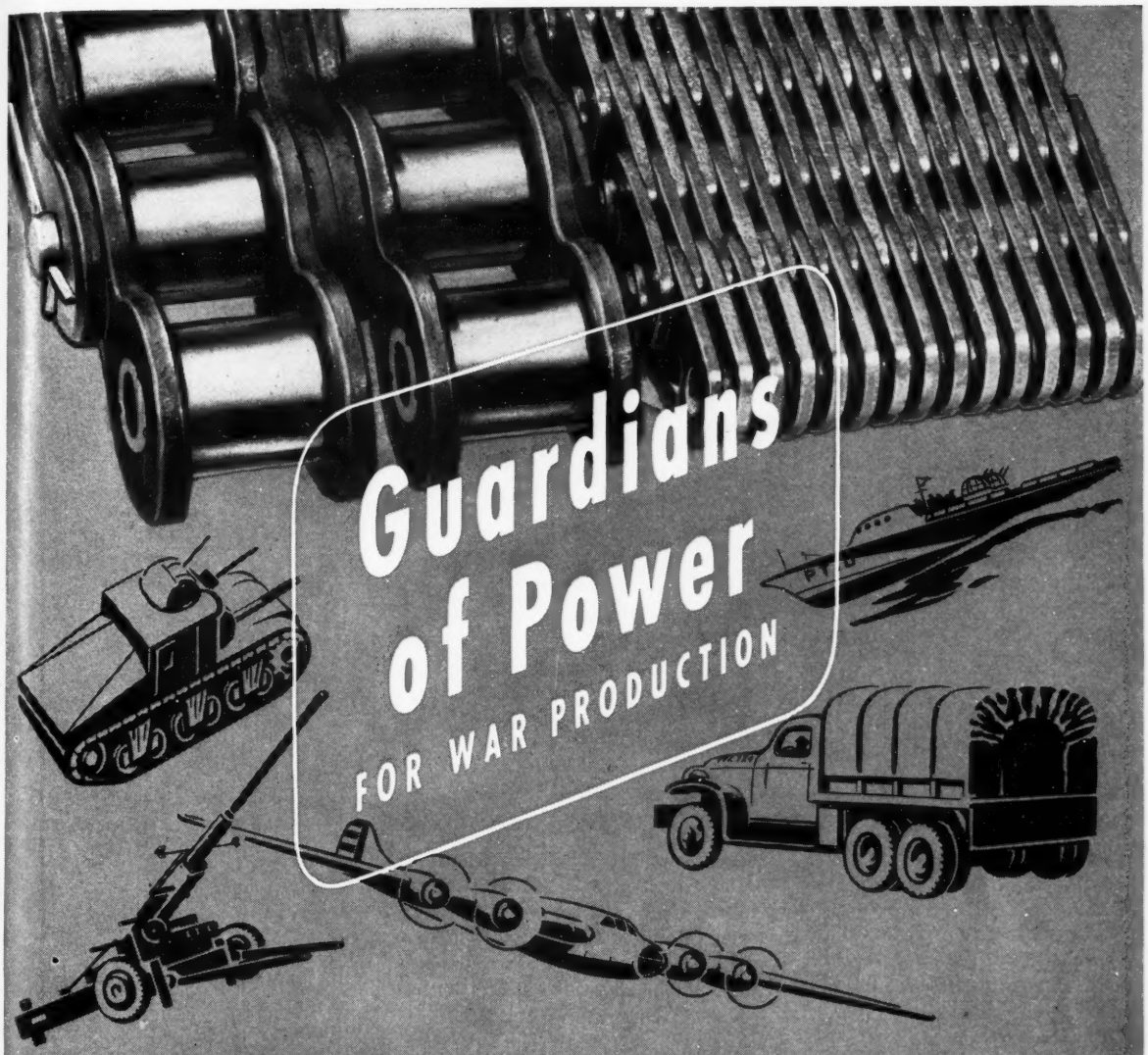

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THE CORNELL CO-OP

Barnes Hall — On The Campus

Norton Printing Co.

317 East State Street

Ithaca, New York

"WHERE SERVICE IS A HABIT"

Donald Pierce

(*Continued from page* 17)

is holding down No. 6 oar on the crew right now. Before joining the Navy, while attending school as a civilian, he became a member of Chi Phi fraternity.

When questioned about future plans (Pierce's Private Post-War Planning) there is but one word that looms . . . and looms large: Architecture. Don will leave Cornell at the end of this term, and he hopes to go to Camp Endicott to do construction work with the Seabees. But due to time spent in the Ag School he will not have enough credits to graduate. So it'll be back to school the first thing after the war. Then armed with a degree . . . but let Don tell of his plans himself:

"I'd like to get into construction work for a while—it's the CE in me. Then practice straight architecture. Oh, sometime I'd like to get a Master's in Architecture and a C.E. degree, too, but I dunno—time and money . . .

"My ultimate aim is to get back to Cornell and teach, I think. That's looking way, way into the future—but I do want to do it after fifteen or twenty years in the field." And perhaps when we return we can stop in and visit at the room marked simply "Pierce, D. R., Prof. of Arch." and talk of the new plans and the new ideas.

For as Architecture comes more and more into the news, in both its engineering and artistic sides—a piece of architecture that is well designed, is workable and gains its beauty from that workability and simplicity, and from the Architect's ability to properly use his materials—as more and more is heard of post-war housing developments, of post-war city-planning, of post-war land rushes and factory building, one sees again the importance of the architect. It is his task to build so that future engineers will not say "too inefficient use of space," or future peoples say "how inartistic!"

And Don is one who appreciates both the task and the responsibility—an architect who is both a good engineer and an artist.

George Bailey

(*Continued from page* 16)

dergraduate members of Tau Beta Pi, honorary engineering society. His most consistent extracurricular activities, however, are frequent visits to Wells College, where he is affectionately known as "Porge." He is also proud to be a charter member of the new society of Pi Beta Tau, at whose functions he finds ample opportunity to demonstrate a powerful bass voice.

George, once student commander of the 6th Battalion, still likes to sack in early, but usually ends up shooting the breeze till 2230. As his schedule this term is well filled, George is trying to figure out how he can work in a little time in the afternoon for sun bathing. His more serious considerations, however, include his recent pledging to Sigma Chi fraternity, his impending speech on torpedoes to ASME, hopes for future submarine service in the Navy, and a possible post-war course in the Harvard School of Business.

WHY A BATTLE WAGON WEARS 4,000 SAPPHIRES

THE DELICATE PRECISION instruments so essential to the navigation of ships of the sea—and ships of the air—are dependent for accuracy on jewel bearings. There are 4,000 of them in a battleship.

Before the war, synthetic sapphire for these bearings came from abroad. Today, because of concentrated efforts over the past 36 months by THE LINDE AIR PRODUCTS COMPANY, a Unit of UCC, America need never again depend upon an outside source for this hard, smooth, wear-resistant material.

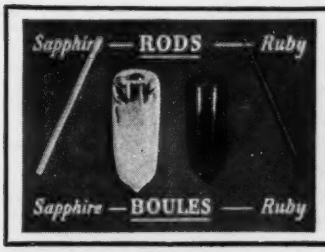
This unusual UCC research project led to the quantity production of Linde sapphire and Linde ruby. These are produced in the form of a single crystal shaped like a cylinder—known as a boule (pronounced "bool")—and also in the form of rods of varying sizes, for more efficient and economical fabrication.

In addition to its indispensability in bearings for military instruments, Linde sapphire already is being used by industry to combat wear in precision gauges, cutting tools, thread guides for textile mills, barometers, compasses, and watches. Phonograph needles that last indefinitely are another interesting use.

American synthetic sapphire production indeed is a tribute to American ingenuity, and promises much for the Nation's postwar progress.

▼

For additional information send for the folder P-4 "Synthetic Sapphire Production."



These objects are Linde sapphire and Linde ruby in boule and rod form—materials of vital importance in military and industrial use. Because they are single crystals that are second only to the diamond in hardness—and can be given a surface that is perfectly smooth—they are invaluable in bearings and in countless other parts where there is wear.

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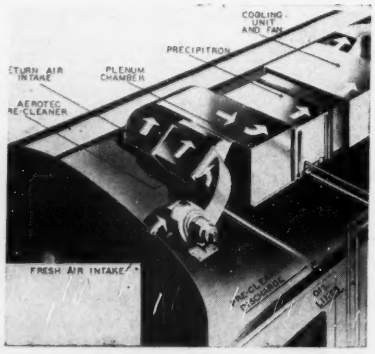
Techni-Briefs

(*Continued from page* 30)

This type of testing is possible because air-flow data is acceptably accurate if the pressure is increased as speed is decreased, in such a ratio that the factor known as Reynold's number remains unchanged. The results obtained are reasonably accurate, certainly within the limits required in the preliminary stages of blade or nozzle study. This allows a great many variations to be tried quickly, greatly expediting the final designs, which can be tested by the slower but more precise high-speed tunnel.

Thermostat

A new thermostat, developed by Westinghouse, saves nearly half the weight of dynamotors for airplane radios. This device, half an inch thick, weighs less than three ounces and is about the diameter of a twenty-five cent piece. In normal service the dynamotor is used only intermittently. If the dynamotor were never to be used continuously on some test or in some needless operation, it could be made to weigh 7½ pounds instead of 12. To achieve this gain, radio designers borrowed from their industrial experience and placed a thermostat of the Thermoguard type inside the dynamotor so that if the dynamotor gets too hot it is simply disconnected from the line. Normally thermal protection is not required for dynamotors, which are simply rotating machines for changing direct-current voltages and hence have no connection to a mechanical load that might stall the rotor.



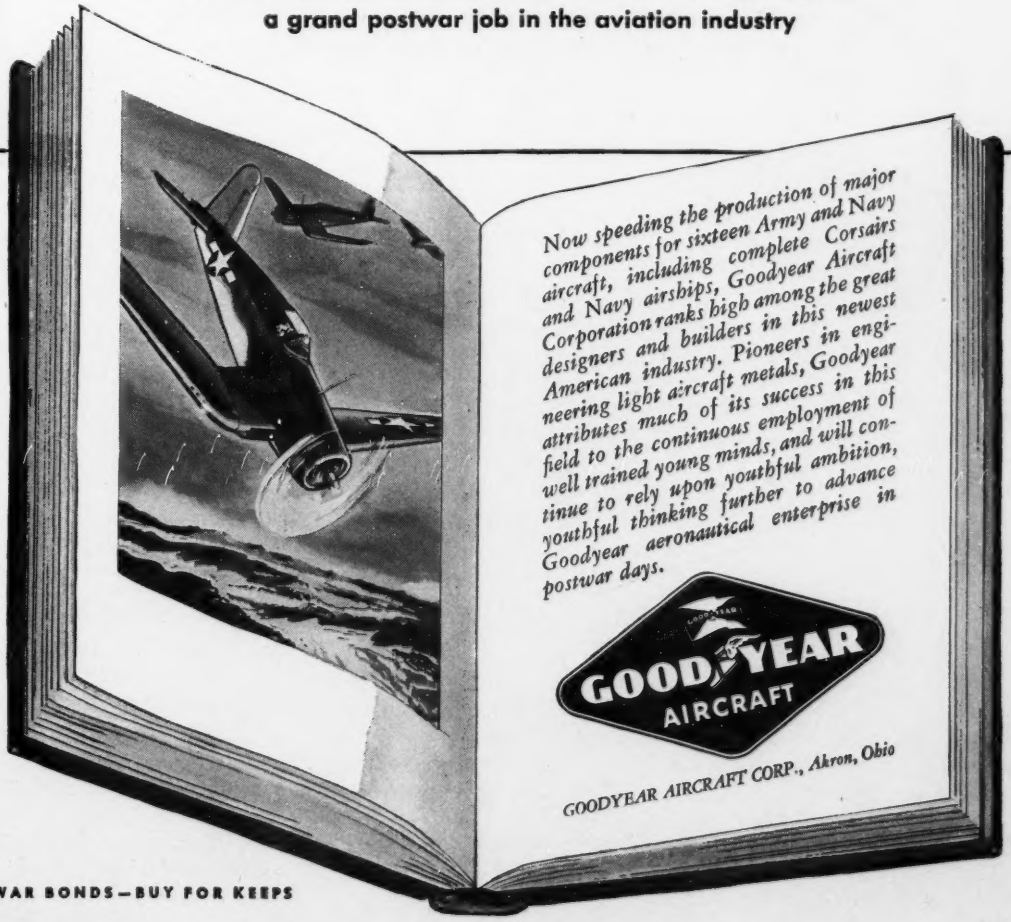
Post-war railroad passenger cars may be equipped with Westinghouse electrostatic air cleaners which will remove the cinders, soot, and roadbed dust before the air goes through the air-conditioning system.

Although dynamotors have been used by the hundreds of thousands in this war and, therefore, are highly perfected, engineers, under relentless pressure to reduce weight of airborne apparatus, are still finding ways to trim off a few ounces now and then. In one case last year they reduced the weight of a dynamotor for a radio receiver from 2½ pounds to slightly under two pounds. To do this the amount of active iron in the core was cut in half; the core was shortened from 1¼ to ⅜ inches. To get the same power out of the lessened material the speed was increased from 6000 to 9000 rpm. Other fractions of inches were whittled out of the frame by mechanical design. To get rid of the higher losses due (to increased friction and windage at the greater speed) from a smaller radiating surface, a tiny fan is pressed over one end of the rotor.

Such weight savings do not come about without some sacrifice in performance, in this case a decline in overall efficiency from 50 to 38 per cent. This sounds bad until it is realized that it means but an additional seven watts loss.

WHO SAYS MATH IS EASY AS PIE ?

It's a fright of a bite now—but it can build you up for a grand postwar job in the aviation industry



Now speeding the production of major components for sixteen Army and Navy aircraft, including complete Corsairs and Navy airships, Goodyear Aircraft Corporation ranks high among the great designers and builders in this newest American industry. Pioneers in engineering light aircraft metals, Goodyear attributes much of its success in this field to the continuous employment of well trained young minds, and will continue to rely upon youthful ambition, youthful thinking further to advance Goodyear aeronautical enterprise in postwar days.

GOODYEAR AIRCRAFT

GOODYEAR AIRCRAFT CORP., *Akron, Ohio*

BUY WAR BONDS—BUY FOR KEEPS

STRESS and STRAIN...

The pretty young teacher was explaining the difference between concrete and abstract.

"Concrete means something you can see," she said, "abstract, something you can't. Who can give me an illustration?"

A boy in the back row raised his hand. "My pants are concrete," he said, "Yours are abstract."

* * *

Stranger: "I've come out here to make an honest living."

Native: "Well, there's not much competition."

* * *

"Oh, you sailors are all alike, thank goodness!"

Mary has a little swing
It isn't hard to find
Everywhere that Mary goes
The swing is right behind.

* * *

Gert: "And then he and I talked about the weather."

Flirt: "About the weather?"

Gert: "Yeah. Whether to, or not to."

* * *

"I don't believe in Darwin's theory of evolution."

"Neither do I. I think some woman made the first monkey out of man."

BANZAI !

Overheard at the chow hall:

Ch. Sp.: "Just between the two of us, Lieutenant, you should remember to pull down the shades in your quarters. When I passed last night, I saw you loving your wife."

Lieut (jg): "The joke is on you. I wasn't home last night."

Coed: "We must be getting home; we girls are out after hours."

V-12er: "That's okey, we sailors are out after ours, too."

* * *

The Proverb of the Month: Every dog has its day, but a dog with a broken tail has a weak end.

And there's the girl who swiped her mother's corset, but didn't have the guts to wear it.

* * *

Many a tight nut has been loosened by a small wench.

* * *

Mary had a swimming suit
Quite pretty, I've no doubt.
But when she puts herself inside
The most of her stays out.

* * *

He who laughs last has found a double meaning that the censor has missed.

* * *

"A woman," says a news item, "is a person who can hurry through a drug store aisle fifteen inches wide without brushing against the glassware and then drive home and knock one of the doors off a twelve-foot garage."

* * *

"So you think Sue's face is her fortune?"

"I'm sure of it. It runs into a nice little figure."

* * *

Their cars having collided, Pat and Mike were looking over the damage. Pat offered Mike a bottle. Mike drank and Pat returned the bottle to his pocket.

"Thank ye," said Mike, "but aren't ye going to have a bit of a nip yourself?"

"Aye," replied Pat, "but not until after the police have been here."

* * *

A bathing suit—like a barbed wire fence—is designed to protect the property without obstructing the view.

* * *

Four marines were playing bridge in a small hut on Wake Island. Suddenly another leatherneck burst into the room and shouted: "The Japs are landing a force of about 200 men down on the beach."

The four bridge-playing marines looked at one another. Finally one said, "Oh, well, I'll go, I'm dummy this hand anyway."